Corrigenda

CAPT. HUTTON'S PAPER ON THE CULTIVATION OF SILK IN THE AUSTRALIAN COLONIES.

Page 154.—Line 5 below for "*Bombayx*" read "*Bombyx*."

" 156.—Line 5 for "*four for*" read "*for four*."

" 158.—Line 10 for "*injurious*" read "*injuriously*."

" 163.—Line 4 below for "*were*" read "*was*."

" 169.—Line 15 below for "*Lamellicorn*" read "*Longicorn*."

" 176.—Line 18 for "*exuviæe*" read "*exuviæ*."

JOURNAL

OF THE

Agricultural and Horticultural Society

OF

INDIA.

Rice Statistics for Bengal, Behar, and Orissa.

THE information recently published in detail regarding the yield of rice, descriptions raised, cost thereof, and mode of cultivation in Lower India, has, it would appear, been read with interest by many Members of the Society and the general public. The request for a tabulated statement of such information has since been brought so urgently to the notice of the Council, that it has been resolved to re-produce it in the following condensed form, as a companion to that already given, in Vol. II., Part 1, (N. S.) pages 25 to 137.

Note on Sericulture in British Burma; by Lt.-Col. H. A. Browne, *Depy. Commissioner, Thayetmyo: with a few remarks thereon. by* Capt. Thomas Hutton, *F. G. S.; C. M. Z. S., Corresponding Member of the Society.*

Introduction of Silk-worm.

Concerning the period at which and the country from which the silk-worm and mulberry were first introduced into Burma, nothing certain can be ascertained from the traditions of the people themselves. From time immemorial, the present silk-growers and their fore-fathers have been engaged in the manufacture. Neither the worm nor the mulberry are indigenous, *i. e.,* neither of them are found in a wild state. They appear therefore to have been imported, and I am inclined to agree with the prevailing belief that they were introduced by the valley of the Irrawaddy from Assam or China, and not across the mountains from India.

Occupation distasteful.

2. The occupation of manufacturing silk in British Burma is a lucrative one, and many parts of the country are admirably adapted for it. That under these circumstances the occupation is not more extensively followed than it is, is due mainly to the Budhistic prejudice against the taking of life. The manufacture of raw silk of the best quality involves the death of the chrysalis in the cocoon, an act of impiety which is looked upon by orthodox Budhists with horror. The people who live by the commission of this sin therefore are considered by their neighbours as of "low caste," if such a term can be appropriately used with regard to a people who acknowledge no distinction of caste. The silk-growers live in villages by themselves, and hold but little social intercourse with their neighbours for fear of being taunted with allusions to the wickedness of their calling. In the Eastern Yoma range these

people, though of pure Burman descent, have come to be regarded as a distinct tribe and are called Yabaings or Zabaings.

Cultivation of mulberry.

3. The Burman mulberry *(Morus Indica ?)* is a thin, lanky shrub, throwing out several vertical shoots from near the ground, and growing to a height of eight or ten feet. It has no flower or fruit, and is propagated by cuttings. After about three years, a plantation of mulberry trees ceases to produce good and succulent leaves, and is then uprooted or abandoned. The plant is grown chiefly on the slopes of hills, but a small quantity is likewise produced on alluvial soil by the margin of mountain streams, where it appears to thrive well, though the silk produced in such localities is inferior to that obtained on high land. The Burmans call it "Po-tsa-beng" (literally "silk-worm's food tree.") I am not aware whether it differs from the *Morus Indica*, but have sent some plants to the Horticultural Society at Rangoon with the view of ascertaining its species.

If the mulberry leaves fail, the worms are fed on the leaves of the *Broussonetia papyrifera* (Burmese Mahlaing-beng) a tree belonging to the mulberry family, from the bark of which Burmans also make their coarse paper known as "*paraback*." The leaves of the above two trees are the only ones ever used to feed silk-worms upon in British Burma, or at least in this District.

Inferior quality of silk.

4. The silk produced in Burma, though admirably adapted for the manufacture of the strong coarse silks so universally worn by the natives of the country, is of a very rough and inferior description, and would, it is believed, be almost unsaleable in Europe. The European value of a specimen of it was in 1855 estimated by the Calcutta Chamber of Commerce at 5 shillings or 6 shillings a pound, or not much more than half the price which it fetches in the local market.

5. In British Burma the manufacture of silk is carried on in the Districts of Prome, Thayet, Henzadah, and Toungoo, and in the northern portion of the Rangoon District. The mulberry is grown chiefly on the slopes of the Yoma range—the watershed between the valleys of the Irrawaddy and Sittoung. A small quantity also is grown on the eastern slopes of the Arakan range, and a still smaller quantity in the valley of the Pairee stream which rises on the Arakan range. The silk produced here (on the Pairee) fetches a lower price than that grown on the high lands; but the people make a profit by the sale of the eggs which are taken across to the silk-growing localities on the east of the Irrawaddy and sold there. The whole of the silk produced is used in local manufactures. None of it, it is believed, finds its way to the Rangoon market.

Statistics of production.

From the information I have collected, the following appear to be the most prominent statistics connected with Sericulture in the Districts of Prome and Thayet, the two northernmost Districts of Pegu extending on both sides of the Irrawaddy, from the Yoma range on the east to the Arakan mountains on the west, covering an area of 5,500 square miles and containing a population of 360,712 souls. The number of persons engaged in silk culture is 713, of whom 422 are men, and 291 women. The number of acres under mulberry cultivation is 452, and the average annual out-turn of raw silk is 5,469 viss (1 viss=3·65lbs.), or about 9 tons. The price of the raw silk when brought to the markets on the river bank varies between Rs. 15 and Rs. 24 a viss, and the average price is about Rs. 20. The value of the whole at this rate will be Rs. 1,09,380, or £10,938. The above statistics for Prome and Thayet may be depended upon as tolerably accurate, though, as the information is obtained from silk-growers themselves, the out-turn of silk is probably rather under than over the mark. I have no statistics to guide me

in estimating the amount of silk produced in the other Districts, but I have travelled through them and believe that the following estimate is not far wrong.

Toungoo probably produces as much as Prome and Thayetmyo together, and Rangoon and Tharrawaddy together about the same amount. This will make the total out-turn of raw silk in Pegu amount to 16,400 viss, or about 27 tons, of the value of £32,800.

Silk is produced also along the Yoma range beyond the British frontier in Burma Proper.

Method of manufacture.

6. The method pursued by the manufacturers of raw silk in British Burma is rude and careless in the extreme. All the processes are carried on in the ordinary bamboo dwelling-houses of the country, which are open to all the elements, and generally smoke-begrimed and dirty. The worms and cocoons share the accommodation with the family of the house-owner, and live and thrive in close proximity to the place where the culinary and other domestic operations of the household are carried on.

The Japanese silk-worm is said to be of such delicate organization as to be seriously affected by bad smells or tainted air. He certainly must be a much more sensitive insect than his Burman *Congener,* and his life in a Burman hut would be a very brief one.

The plant of a Burmese silk filature is simple and inexpensive, consisting only of the following articles :—A number of circular flat trays with slightly raised edges. They are made of strips of bamboo, plaited, and are from 2 to 4 feet in diameter ; some neatly made circlets of palm leaves three or four inches in diameter; some strips of coarse cotton cloth; a common cooking pot; a small bamboo reel; a round block of wood, with handle and axes turning on wooden or bamboo supports, and a two-pronged fork.

The different processes commencing from the the time when

the eggs are laid are as follows :—The males and females having completed the procreating process, the males are thrown away and the females placed within palm leaf circlets on a sheet of coarse cotton cloth, two or three feet square. The eggs are then deposited on the cloth, and as they adhere to it the cloth becomes covered with circular cartoons of eggs. These cartoons when sold, are sold at the rate of about eight for a rupee.

The moths having completed the laying of their eggs, which takes them about a day, they (the moths) are thrown away. The pieces of cloth with the eggs are wrapped up and left to themselves. About the eighth day the eggs are hatched: the cloths are then opened and worms begin to appear. As the worms, tiny little black specks, emerge, they are swept by a feather off the cloth on to a tray. The worms cling tenaciously to the cartoons and cannot be shaken off. The feather-brushing operation, though rough, does not appear to hurt them. The produce of one circular cartoon will more than fill one large tray 2 or 3 feet in diameter with worms when full grown. The worms are hatched in the morning. In the afternoon they are fed with finely chopped-up pieces of the tenderest mulberry leaves. This goes on for four or five days, when the worms become torpid, sleep for 24 hours, and shed their skins. They then become voracious and require plenty of strong leaves. Beyond being plentifully supplied with food, they receive but little care. Very little attention is paid to cleanliness. They live and thrive on heaps of *excreta* and refuse leaves, and they bear handling of the most rough and reckless description, being scraped up in handsful and tossed about in a way which looks most dangerous to their delicate frames.

Their only enemy appears to be a kind of blue-bottle fly, which, when a tray is exposed, alights for a second, punctures and lays its eggs on the body of a worm. These worms become unhealthy, and are generally picked out and thrown

down through the bamboo flooring to the fowls which lie in wait for them below the house. If such worms are allowed to make cocoons, the fly eggs develop in the chrysalis and spoil the cocoons. To protect the worm from this fly, the trays are generally kept covered with a cloth.

The silk-worm's existence lasts about 30 days, during which period he becomes torpid and moults four times. When "ripe," or ready to commence cocooning, their colour changes from a bluish to a pinky white. The ripe ones are then picked out by the hand and thrown in heaps on to a small tray, in which they are conveyed to the cocooning tray. This is a large sized tray, 3 or 4 feet in diameter, within which a long ribbon of plaited bamboo, a couple of inches wide, is wound round and round with its edges on the flat of the tray. The worms are then taken up in handsful and scattered with as little care as if they were so many grains of corn over the tray. They gradually find their places and then spin their cocoons, attaching them to the walls of the plaited bamboo.

Whilst this operation is going on, the trays are covered with a cloth. The cocoons are generally yellow; some few are pure white. In 24 hours the cocoons are completed. They are then torn away from the tray and placed in baskets. In two or three days those cocoons from which the best silk is to be reeled are taken out and placed in a pot (the family cooking pot) of water, which is allowed to simmer over a slow fire. Above the pot is placed a pair of cross sticks from which a bamboo reel is suspended, and beside the pot is a wooden cylinder turning on a trestle. Some filaments of silk are caught and drawn out of the pot, run over the bamboo reel, and fastened to the cylinder.

Then the reeler (generally a woman) with an iron fork in one hand and the handle of the cylinder in the other, keeps catching up the filaments in the pot with the fork and reeling them on to the cylinder. The thread produced is coarse and

dirty, and brings with it from the pot bits of pupa and other refuse, all of which goes with the silk on to the cylinder.

The silk in the pot having been exhausted, the denuded grubs are taken out and fried in oil; they form a savoury addition to the family dinner.

Those cocoons which are left to produce moths are ready in about eight days. The moths are then formed. As they emerge they are put into large trays and kept there for a day, during which time the coupling process goes on. The males having been thrown away, the females are arranged on a cloth as before described to lay their eggs.

A coarse and inferior kind of silk is reeled off the cocoons which have been allowed to come to maturity. This silk fetches only a third of the price obtained from those cocoons which are reeled whilst the chrysalis is still in them, but as, by this process, the sin of taking life is avoided, it is preferred by some who are more attentive to the duties of religion than their neighbours.

The length of the different stages making up the cycle of the Burman silk-worm's existence is as follows:

Eggs	...	8 days, or 11 days in cold weather.
Worm	...	30 „
Cocoon	...	8 „
Moth	...	1 „
Total	...	47 days

From the completion of the cocoon to the appearance of the worm therefore there are only 17 days in the hot weather and 20 days in the cold weather. This is altogether too short a time to allow of the Burman species being conveyed to Australia (by one stage at least) with any hope of success.

Improvement of silk manufacture in British Burma.

7. The chief merit of the Burman silk-worm appears to be its extreme hardiness as compared with other species. Whether the

coarseness of its silk is inherent in the nature of the worm, or is due to the rough and careless manner in which it is treated, my limited knowledge of silk manufacture does not enable me to say. There certainly appears to be room for improvement as far as concerns the manufacture of silk fitted for the European market. Whether the manufacture of such silk would pay the growers better than the manufacture of the coarse stuff they now produce, I can hardly say. But any recommendations for the improvement of the present system of silk culture made by a person having a competent knowledge of the subject, would not be wasted on the Burman silk growers, provided such recommendations were at all feasible.

The silk growers are quite ready to adopt any measures, whether by the introduction of new breeds of silk-worms or the improvement of their machinery, which may be expected to be profitable.

THAYETMYO; 16*th August*, 1870. HORACE A. BROWNE, *Deputy Commissioner.*

Remarks by CAPT. HUTTON.

Para. 3.—I doubt if the mulberry tree is the *Morus Indica,* as doubtfully stated, because it is not the character of that species to be "thin and lanky, throwing out several vertical shoots from near the ground and growing to a height of eight or ten feet.

Morus Indica of the North-Western Provinces, the leaf of which Mr. Scott recognized, grows straight up in one stem, and becomes a sturdy tree of from 25 to 30 feet high; it is a fine, handsome, wide-spreading species. Besides which, it *bears both flowers and fruit.* The notion that mulberry trees after three years cease to produce good and succulent leaves and is then to be uprooted and abandoned, is simple nonsense,

founded upon some wise crotchet of the people! At three years old the tree produces no fruit, *because* it has not yet arrived at maturity! Silk produced on the banks of streams is always inferior to that from drier soils; the tree requires a moderately damp soil, but not a watery one.

"If the mulberry leaves fail, the worms are fed on the leaves of the *Broussonetia papyrifera*, a tree belonging to the mulberry family." This is a novelty, for hitherto no proper substitute for the mulberry leaf has been found; it may eventually prove to be a discovery of some importance, and the Society should lose no time in procuring young plants and the seeds of the tree.

Para. 6.—No really good silk can be expected from Burma while the worms are subjected to such vile treatment.

I am much inclined to think that the species here described is not to be found among those domesticated in Bengal, for first, I know of no species that deposits its ova in rings; wide straggling circlets are often formed by the moth confining itself to one centre and describing an irregular circle with its ovipositor; but more generally speaking, the moth moves about and scatters the eggs widely over the cloth or paper. *B. textor* when in health has some propensity to deposit the eggs in rings, but not with such regularity as that described.

Again, we perceive a difference in the stated fact that at the season of forming the cocoon "the colour (of the worm) changes from a bluish to a pinky white." Our *B. fortunatus* is the only worm that assumes a bluish or leaden hue, but I never witnessed any change to pinkish white. It is a curious fact that the Burmese method of winding a long strip of plaited bamboo, a couple of inches wide and coiled round the tray like the main-spring of a watch, is precisely that which I many years ago adopted for the use of *B. mori*, and found it to answer with less loss of silk, better than any other method.

"The cocoons are generally yellow; some few are pure

white." This, however, is often the case with *B. textor*, *B. Sinensis* and some others, and affords no ground on which to establish a species. Only procure it and we will soon "divulge his name and family." The method of reeling is far too complicated and scientific for my old brains.

Here is an intimation that the empty cocoons can be reeled, a fact which I formerly mentioned, though I could not then, and cannot even now, remember the source of my information. The difficulty of reeling these consists in the lightness of the cocoon when free of the pupa causing it to be constantly drawn up out of the basin, but this might be prevented by inserting a few large shot into them. The time given from the egg to maturity is 47 days; the time taken by *B. mori* at Mussooree, though I doubt if that species would thrive in Burma. This, however, is settled by there being both summer and winter crops, so that the species is either a bivoltine or polyvoltine.

Report on the germination of the Vegetable and Flower Seeds imported by the Society in 1869, by JOHN SCOTT, *Esq., Curator of the Royal Botanical Gardens.*

I send you, in a tabular form, the results of the second sowings of your imported seeds, to which I have added, for the sake of comparison, a column for those of the trial sowings in the rainy season. The comparative results are interesting, as indicating the different powers of the various seeds to resist, under similar conditions, the effects of the rainy season; as also those kinds, with really good seeds, which do not readily germinate in that season.

I may note the general results: Landreth's vegetable seeds in the first trial, germinated on an average 50 per cent.; in the second, 27 per cent. only. Vilmorin's afforded 53 and 45 per cent.; and Carter's 41 and 31 per cent. The deterioration of the American seeds is remarkable, and presents a marked contrast to those of the French and English, which have been very equally affected; in the one case the germinative faculty is reduced by 8, in the other by 10, while in the American, it is reduced by the high percentage of 23.

Again, with regard to the flower seeds, I find that the germination of Vilmorin's in the first sowing is, on an average, 10 per cent.; in the second, 9 per cent.; Carter's, from 2 to 4 per cent.; thus in both cases affording very different results from those which I had the pleasure to submit to you last year.

	No. of Seeds sown.	Germination.	Germination on previous sowing.
CARTER'S VEGETABLE SEEDS.			
Peas, Veitch's perfection	20	4	2
„ Daniel O'Rourke	20	4	6
„ Batt's Wonder	20	10	5
„ Champion of England	20	1	8
„ Bedman's Imperial	20	19	6
„ Princess Royal	20	15	8
„ McLean's Wonderful	20	3	3
Cress, Triple-curled	20	18	1
Beans, French	20	3	17
Mustard, White	20	14	19
Carrot, selected, Scarlet	20	...	17
Cabbage, Improved, Red Dutch	20	1	13
Onion, White Spanish	20	...	7
„ Italian Triple	20	...	6
Brocoli, early White	20	7	15
Turnip, Orange Jelly	20	20	20
Asparagus, Giant	20	4	10
Beet, Carter's long Red	20	12	12
Squash, mixed, American	20	1	19
Radish, mixed, Turnip	20	10	1
Cabbage, early York	20	12	12
Carried over ...	420	158	207

	No. of Seeds sown.	Germination.	Germination on previous sowing.
Brought forward ...	420	158	207
CARTER'S VEGETABLE SEEDS.—(*concld*).			
Celery, Manchester, White	20	...	...
Lettuce, Neopolitan, Cabbage	20	...	1
Cauliflower, Carter's dwarf Mamoth ...	20	6	...
Parsley, best-curled ...	20	...	5
Lettuce, Carter's Giant, White & Co.'s	20	...	...
Knol Kohl	20	...	8
Total ...	540	164	221
CARTER'S FLOWER SEEDS.			
Nemesia cœrulea	50	...	...
Cineraria, splendid hybrid	50	...	...
Lavender	50	...	...
Leptosiphon luteus	50	...	...
Mesembryanthemum, finest mixed	50	...	...
Bartonea aurea	50	...	1
Ferdinandia eminens	50	...	...
Hollybock, finest prize	50	13	1
Eutoca Ortigiensiana	50	15	...
Lupinus Dunnetti superbus	50	...	1
Viola cornuta	50	...	...
Ipomopsis elegans	50	...	...
Carried over ...	600	28	3

	No. of Seeds sown.	Germination.	Germination on previous sowing.
Brought forward ...	600	28	3
CARTER'S FLOWER SEEDS.— (*contd.*)			
Browallia, finest mixed	50	...	...
Convolvulus Mauritanicus	50	..	...
Linum grandiflorum	50	6	7
Rhodanthe Manglesi	50	...	...
Chrysanthemum, large flowered	50	.	...
Cobæa scandens	5	.	.
Ipomæa, mixed variegated, various	5	...	1
Nasturtion, King of Tom Thumb	5	...	4
Tropæolum Lobbianum, finest mixed	5	...	2
Total ...	870	34	17
VILMORIN'S VEGETABLE SEEDS.			
Pea, Bishop's, long pod dwarf	20	14	14
,, Dwarf, blue Prussian	20	11	15
,, Prince Albert, extra early	20	12	15
,, Ruelle Michaux	20	14	..
,, Clamart, late	20	18	20
,, Double-blossom, France	20	12	19
,, Knight's, tall marrow	20	5	18
,, Dwarf, green marrow	20	5	5
Carried over ...	160	91	106

	No. of Seeds sown.	Germination.	Germination on previous sowing.
Brought forward ...	160	91	106
VILMORIN'S VEGETABLE SEEDS.—(*concld.*)			
Beans, Flageolet, long, early white	20	16	19
„ Bagnonet, black, speckled	20	16	20
Asparagus, Giant Dutch	20	14	14
Tamato. large red	20	17	20
Sage	20	...	..
Lettuce, white Paris cos	20	1	..
Squash, vegetable marrow	20	12	17
Marjorum sweet	20	...	3
Cauliflower, half early, Paris	20	1	9
Cucumber, green long prickly ..	10	7	10
Radish, long scarlet	20	14	14
Beet, dark-red (Crapaudine or rough) .. .	20	3	6
Celery, purple giant solid	20	7	7
Onion, white early silver-skin .. .	20	..	3
Artichoke, green globe	20	16	6
Melon, mixed	10	3	10
Cabbage, sugar-loaf	20	12	8
Carrot, long, red Surrey	20	1	3
Thyme	20	...	7
Turnip, early white flat Dutch	20	11	..
Total ...	540	242	282

	No. of Seeds sown.	Germination.	Germination on previous sowing.
VILMORIN'S FLOWER SEEDS.			
Erysimum Petrowskianum	50	...	3
Aster, French; extra fine, mixed	50	..	1
Chrysanthemum Indicum, mixed	50	..	
Phlox Drummondii, mixed	50	..	.
Tunica sexifraga	50	..	3
Petunia, hybrid, mixed	50	.	2
Calendula, double	50	18	
Portulaca grandi flora, mixed	50	..	...
Heartsease, mixed	50	.	
Sweet William, mixed	50	...	2
Balsam, Camellia, flowered, double mixed ..	50	27	11
Nierembergia frutesceus	50	2	2
Verbena, hybrid, mixed	50	.	.
Amaranthus, bicoloro, ruber	50	12	12
Obeliscaria pulcherrima	50	8	3
Convolvulus tricolor, mixed	50	9	20
Gilia tricolor	50	.	..
Salpiglogsis, hybrid, mixed	50	4	1
Zinnia, elegans, double mixed.	50	1	4
Cobæa scandens	5	...	2
Total ...	955	81	99

	No. of Seeds sown.	Germination.	Germination on previous sowing.
LANDRETH'S VEGETABLE SEEDS.			
Peas, Champion of England	20	9	18
„ Tall sugar	20	19	19
„ Advancer	20	14	17
„ White marrow-fat	20	1	20
„ Extra Early	20	14	17
„ Bishop's dwarf, Long pod ...	20	7	19
„ Tom Thumb ...	20	15	16
„ Early frame	20	18	20
„ Blue, Imperial	20	8	18
„ Royal, dwarf, marrow-fat	20	9	19
„ White, marrow-fat	20	2	20
„ Black-eyed, marrow-fat...	20	15	18
Beans, Large Lima	20	...	15
„ Scarlet runner	20	...	16
„ Red French	20	...	14
„ Cauliflower, Early Asiatic	20	2	11
„ Late	20	3	14
Cabbage, Drumhead, Savoy	20	14	18
„ Red Dutch, for pickling	20	2	2
„ Early York	20	6	10
Carried over ...	400	158	321

	No. of Seeds sown.	Germination.	Germination on previous sowing.
Brought forward ...	400	158	321
LANDRETH'S VEGETABLE SEEDS.—(*contd.*)			
Cabbage, Early Sugar-loaf	20	1	12
„ Green turnip-rooted ...	20		12
„ Early Battersea	20	1	10
Lettuce, white cos	20	.	..
„ Ditto, Royal Cabbage	20	1	...
Turnip, Yellow Aberdeen ..	20	10	20
„ Early Dutch, white flat	20	2	20
Radish, Golden Yellow Turnip	20	11	9
„ White Turnip	20	...	15
Celery, white solid	20	4	...
„ Red solid	20	2	.
Radish, Scarlet turnip rooted . ..	20	...	4
Parsley, Curled	20	...	.
Mustard, White	20	18	14
Carrot, long Orange ..	20		5
„ Early horn	20	..	10
Asparagus, large purple-top	20	.	.
Onion, large Yellow Strasburg	20	...	...
Artichoke, large globe	20	...	...
Tomato Tilden	20	...	1
Carried over ...	800	208	453

	No. of Seeds sown.	Germination.	Germination on previous sowing.
Brought forward ...	800	208	453
LANDRETH'S VEGETABLE SEEDS.—(*concld.*)			
Cress, curled, or Pepper Grass	20	18	...
Brocoli, Purple Cape	20	...	6
Leek, London	20	...	...
Sage	20	...	...
Basil, Sweet	20	..	...
Marjoram, Sweet	20	16	...
Beet, long red	20	14	6
Cucumber, early frame	10	2	8
Water-melon, Mountain sweet	10	2	4
Squash, Marrow	10	...	2
„ Hubbard	10	1	6
Total ...	980	261	485

ROYAL BOTANICAL GARDENS; }
14*th December*, 1869. }

JOHN SCOTT,
Curator, Royal Botanical Gardens.

Report on the Germination of the Vegetable and Flower Seeds imported by the Society in 1870; *by* JOHN SCOTT, Esq., *Curator of the Royal Botanic Gardens.*

I enclose a tabular statement of the results of my trial sowings of your vegetable and flower seeds. The results show the high quality of the seeds, and though a few (as shown in the tables) failed on the first sowing during the rains, in a subsequent trial, I have got all to germinate, so that, should you have complaints from Members, the fault lies not in the seed, but in the bad management of those who fail, should there be any.

11*th November*, 1870.

EGETABLE SEEDS.

Vilmorin, Andrieux, & Co.					D. Landreth & Sons.					Law, Somner, & Co.				
No. of Kinds.	1-25	25-50	50-75	75-100	No. of Kinds.	1-25	25-50	50-75	75-100	No. of Kinds.	1-25	25-50	50-75	75-100
6	5·5				9	9·4				9	13·3			
5	...	41·5			11	...	44·6			3	...	36·2		
5	...	...	61·		6	...	...	65		7	...	.	68·4	
1	...	...	...	83·2	18	...	...	...	33·1	9	...	.	...	94·4
1	Failed				3	Failed				3	Failed			
28					47					31				

FLOWER SEEDS.

Vilmorin, Andrieux, & Co.					Law, Somner, & Co.				
No. of Kinds.	1-6	6-20	20-50	50-90	No. of Kinds.	1-6	6-20	20-50	50-90
5	4·2				4	4			
1	..	16			1	...	10		
7	...	...	32·5		2	...	...	35	
4	...		..	66·2	5	Failed			
3	Failed								
20					12				

VEGETABLE SEEDS.

	From Messrs. Vilmorin, Andrieux, & Co.				From Messrs. D. Landreth & Sons.				From Messrs. Law, Somner, & Co.			
	No. of Seeds sown.	No. of Seeds germinated.	100		No. of Seeds sown.	No. of Seeds germinated.	100		No. of Seeds sown.	No. of Seeds germinated.	100	
Asparagus, Giant Dutch	20	8	...	40								
„ Large purple top	...	...	...	...	20	8	...	40				
„ Giant	...	...	...	...	...	...	...	...	20	4	...	20
Artichoke, green-globe	20	9	...	45								
„ Large globe	...	...	...	...	20	10	...	50				
Brocoli, purple Cape	...	...	...	...	20	18	...	90				
„ Southampton	...	...	...	...	...	...	...	...	20	15	...	75
Beet, dwarf, deep blood-red	20	18	...	90								
„ Long blood-red	...	...	...	...	20	none						

VEGETABLE SEEDS.—*continued.*

	From Messrs. Vilmorin, Andrieux, & Co.				From Messrs. D. Landreth & Sons.				From Messrs. Law, Somner, & Co.			
	No. of Seeds sown.	No. of Seeds germinated.	100		No. of Seeds sown.	No. of Seeds germinated.	100		No. of Seeds sown.	No. of Seeds germinated.	100	
Beet, Blood red	...	...	...	...	...	...	...	...	20	1	...	5
„ Perpetual Spinach												
„ Cattell's selected, dwarf red ...												
Basil, Sweet	...	...	...	...	20	3	...	15				
Basilla, Alba												
Beans, Bagnolet, black speckled	20	16	...	80								
„ Flageolet, long early white ...	20	16	...	80								
„ Scarlet runner	...	...	...	...	20	12	...	60				
„ Large Lima...	...	...	...	...	20	16	...	80				
„ Red French...	...	...	...	...	20	18	...	90				

,,	Negro, long pod kidney								..	20	19	...	95
,,	Early, pale dun ...	...							...	20	20	...	100
,,	White Dutch runner ...	...							...	20	18	...	90
,,	Soissous, runner French... ...												
,,	Beck's Gem...												
,,	Mohawk or Napoleon runner French Beans												
,,	New, violet podded												
Cabbage,	Oxhead, large	20	18	...	90	—							
,,	Drumhead Savoy	..	...	...	...	20	18	...	90				
,,	Early Battersea			...	..	20	7	...	35				
,,	Green, turnip rooted	...	...	...	...	20	9	...	45				
,,	Early York	...	.	...	...	20	1	...	5	50	5	...	25
,,	Red Dutch	...	.	..	...	20	13	...	65				
,,	Early sugar loaf	...	...	...	...	20	10	...	50				
,,	Pickling, red	...	...	...	...	...	...	...	...	20	12	...	60
,,	Early, St. John's duz												

VEGETABLE SEEDS.—*continued.*

	From Messrs. Vilmorin, Andrieux, & Co.			From Messrs. D. Landreth & Sons.			From Messrs. Law, Somner, & Co.		
	No. of Seeds sown.	No. of Seeds germinated.	100	No. of Seeds sown.	No. of Seeds germinated.	100	No. of Seeds sown.	No. of Seeds germinated.	100
Cabbage, Early Dwarf Warrenheep									
„ Chinese									
„ Basil									
Cauliflower, half early, Paris	20	11	55						
„ Early Asiatic	...	...	...	20	12	60			
Cauliflower, late	...	...	...	20	14	70			
„ Walcheren	...	...	...	...	...	...	20	12	60
„ Lenormand, Short stem									
Carrot, long red, Surrey	20	8	40						
„ Early horn	...			20	7	35			

„ Long orange					20	3		15				
„ Scarlet horn	...						...	...	20	6	...	30
„ „ Intermediate												
Celery, purple giant, solid	20	1	...	5								
„ Red solid	...	...	...		9	8		40				
„ Large, white solid	...	...	...		20	9		45				
„ White solid		...	...	...		...	...	...	20	15	...	75
„ Cole's, crystal white												
„ Cress, curled or pepper grass	...	...		...	20	17	...	85	20	20	...	100
Cucumber, green, long prickly	20	9	...	45								
„ early frame	...	...	...	...	20	1	...	5				
„ long prickly	...	...	...	...	...	...	...	...	10	none		
„ Bedfordshire surprise												
Dolichos unguiculatus												
Egg plant, long purple												
Leek, London	...	...	...	...	20	1	...	5				

VEGETABLE SEEDS.—*continued.*

	From Messrs. Vilmorin, Andrieux, & Co.				From Messrs. D. Landreth & Sons.				From Messrs. Law, Somner, & Co.			
	No. of Seeds sown.	No. of Seeds germinated.	100		No. of Seeds sown.	No. of Seeds germinated.	100		No. of Seeds sown.	No. of Seeds germinated.	100	
Lettuce, white Paris Cos.	20	1	...	5								
„ White Cos.	...	..	...	..	20	19	..	95				
„ royal cabbage	...	...	...	...	20	11	...	55				
„ Neapolitan cabbage	...	...	...	...	...	...	..	...	20	1		5
„ Waites, White Cos.												
„ Ivery's, Norwich Cos.												
Mustard, white	..	...	...	...	20	17	...	85	20	17	...	85
Marjorum, sweet	20	none	...	...	20	2	...	10	20	3	...	15
Melon, mixed	10	8	...	80								
„ Reindes, Carnes												

Onion, white early, silverskin ...	..	20	1	...	5								
,, large yellow Strasburgh...	...	...	...	...		20	3	...	15				
,, White, Spanish	...	...	...	...	..	...	..	...	...	20	4	...	20
,, Brown, Spanish	...												
,, Danver's yellow	...												
Okra, long green ...	...												
Parsley, curled ...	...	...	...	...		20	14	...	70				
,, Triple-curled ...	...	...	...	...	...	...	..	...	...	20	6	...	30
Parsnip, round early ...	...	20	1	...	5								
,, Student	...												
Peas, dwarf Dutch	...	20	7	...	35								
,, Prince Albert, extra early	...	20	17	...	85								
Knight's dwarf marrow	...	20	14	...	70								
,, Tall ,,	...	20	12	...	60								
Clamart Late ...	...	20	16	...	80								
,, Tall white flowering scimitar, edible pod	...	20	16	...	80								

VEGETABLE SEEDS.—*continued.*

	From Messrs. Vilmorin, Andrieux, & Co.				From Messrs. D. Landreth & Sons.				From Messrs. Law, Somner, & Co.			
	No. of Seeds sown.	No. of Seeds germinated.	100		No. of Seeds sown.	No. of Seeds germinated.	100		No. of Seeds sown.	No. of Seeds germinated.	100	
Peas, Royal dwarf marrow pod	...	...	...	...	20	19	...	95				
,, Early frame	...	...	...	...	20	16	...	80				
,, Landreth's extra early ...	...	...	...	...	20	18	...	90				
,, Black-eyed marrow pod ...	...	...	...	...	20	16	...	80				
,, Blue Prussian	...	...	...	...	20	19	...	95				
,, Champion of England ...	...	...	...	...	20	20	...	100	20	None.		
,, Bishop's dwarf long pod ...	...	...	...	...	20	19	...	95				
,, Blue imperial	...	...	...	...	20	16	...	80				
,, Carter's surprize	...	...	...	...	...	...	...	...	20	18	...	90
,, Yorkshire Hero	...	...	...	...	...	...	...	...	20	19	...	95

„ Prize Taker ...	...	..	...	.	...	..		.	20	15	...	75
„ Essex rival...	...	..	...		...	..		...	20	20	..	100
„ Queen of dwarf ..	...	...	...	..	...	..		...	20	19	...	95
„ Climax	...	...	...	...	...	..	...	...	20	15	...	75
„ McLean's little gem ...												
„ Carter's first crop ..												
Radish, long scarlet	20	12	...	60								
„ white turnip	...	..	..	...	20	10	...	50				
„ Golden yellow turnip	.	...	...	...	20	17	..	85				
„ Scarlet turnip rooted	...	...	...	...	20	13	...	65				
„ Mixed turnip	..	...	...	...	...	..	...	...	20	4	...	20
„ Scarlet olive-shaped												
„ Long scarlet .. .												
Sage	20	1	...	5	20	1	...	5	20	None		
Spinach, round	...	...	...	...	...	...	...	...	20	1	...	5
Spinage, Flanders, very large ...	20	16	...	80								

VEGETABLE SEEDS.—*concluded.*

	From Messrs. Vilmorin, Andrieux, & Co.			From Messrs. D. Landreth & Sons.			From Messrs. Law, Somner, & Co.		
	No. of Seeds sown.	No. of Seeds germinated.	100	No. of Seeds sown.	No. of Seeds germinated.	100	No. of Seeds sown.	No. of Seeds germinated.	100
Squash, vegetable marrow	10	8	80						
Marrow	...	...	...	10	1	10			
,, Hubbard	...	...	...	10	None				
,, Bush	..	...	...	...	...	...	10	6	60
Tomato, large red	20	18	90						
,, Tilden	..	...	...	20	9	45			
Turnip, early, white flat Dutch	20	12	60						
,, Yellow Aberdeen	..	..	...	20	16	80			
,, Early Dutch, white flat ...	...	...	..	20	20	100			

,, Orange Jelly ...	...	.	...	..				...	..	20	10	...	50
,, Celery, white Dutch ...	..												
,, ,, white stone ...	...												
Thyme	...	20	2	...	10	...	..	...	...	20	1	...	
Water-melon, mountain sweet	..	...	...	...	...	10	None						

FLOWER SEEDS.

	No. of S sown.	No. of S germina		100
FROM MESSRS. LAW, SOMNER, & Co.				
Tropæolum, Tall, mixed ...	10	3	...	30
Balsam, choice, mixed ...	10	4	...	40
Viola odorata	20	1	..	5
Lavender	50	2	...	4
Lupine, mixed	20	1	...	5
Eutoca multiflora	50	None		
Mignonette	50	1	...	2
Wall flower	50	None		
Larkspur, Double German mixed	25	,,		
Clarkia, mixed	10	,,		
Clianthus Dampieri	10	,,		
Portulaca, mixed	50	5	...	10
FROM MESSRS. VILMORIN, ANDRIEUX, & Co.				
Scabious, dwarf mixed ...	50	37	...	74
Nemophila insignis	50	None		
Lupinus Cruickshankii	20	7	...	35
Sweet Pea, mixed	20	6	...	30
Obeliscaria pulcherrima	50	None		
Salpiglossis, hybrid mixed	50	8	...	16
Pot marigold, Nankeen coloured	50	39	...	78
Mignonette, large flowered	50	17	...	34
Verbena hybrida, mixed	50	1	...	2
Schizanthus annuus grandiflorus oculatus ...	50	30	...	60

FLOWER SEEDS.—*concluded.*

	No. of Se sown.	No. of Seeds germinated.	100
From Messrs. Vilmorin, Andrieux, & Co.—*contd.*			
Browellia elata, blue	50	15	30
Phlox Drummondii, mixed	50	11	22
Portulaca grandiflora mixed	50	1	2
Eutoca viscida	50	25	50
French Asters extra fine, mixed	50	14	28
Whitlavia gloxinioides...	50	None	
Linum grandiflorum	50	2	4
Hearts-ease, mixed	50	3	6
Mimulus cupressus hybridus, mixed	50	4	8
Daisy double	50	27	54

Result of Experimental Cultivation in the North-Western Provinces of the American James River Virginia Tobacco Seed; communicated by the Government, North-Western Provinces.

From the Officiating Secretary to the Board of Revenue of the North-Western Provinces, to the Officiating Secretary to the Government of the North-Western Provinces, dated Allahabad, the 11th May, 1870.

Sir,—With reference to Government Order, No. 88, dated 11th June, 1869, Revenue Department, I am directed by the Board of Revenue to submit, for the information of His Honor the Lieutenant-Governor, an abstract of the reports received from the Officers noted in the margin, on the experimental cultivation of American James River Virginia Tobacco during the year 1869.

Superintendent, Botanical Gardens, North-Western Provinces.
Collectors—Seharunpoor.
Meerut.
Agra.
Cawnpore.
Furruckabad.

2. His Honor will observe that the experiments, though conducted by Officers who were sure to give them a fair trial, have not, on the whole, proved successful.

Abstract of Reports on the result of the experimental cultivation of American James River Tobacco Seed.

Superintendent, Botanical Gardens, North-Western Provinces, No. 1249, *dated 6th November,* 1869—States, that the seed having been received too late, was not put into the ground at the usual season. The leaves are therefore small, but their flavour seems excellent.

A sample of the tobacco leaf submitted by the Superintendent was forwarded to the Collector of Allahabad by the

Board, with the request that he would obtain the opinion of the tobacco dealers in the city.

The Collector, in reply, reports, that the tobacco dealers are unanimous in their opinion that the leaf is tasteless and not likely to be in demand in the market.

Collector, Seharunpore, No. 17, *dated* 21*st March*, 1870.—Reports, that he sowed all the seed supplied him, at different seasons of the year, but none germinated.

Collector, Meerut, No. 28, *dated* 23*rd March*, 1870—States, that the seed was distributed to three different parties in January. They have all reported that not a single seed germinated.

Collector of Agra, No. 37, *dated* 4*th April*, 1870.—The seed sown in the Taj and Rambagh gardens, did not germinate. The Collector himself tried the experiment in his own garden. The seed germinated and came up freely after one or two sowings. He sees no reason why the cultivation of the American James River tobacco should not succeed in the North-Western Provinces. It is in the subsequent manufacture of the raw material that there is failure.

Collector, Cawnpore, No. 240, *dated* 25*th April*, 1870.—The seed did not germinate very freely, though sufficient came up to collect seeds from, the Bazar people will not give any better price for it than for the country tobacco, and depreciate it unfairly, the Collector thinks, because it was not manufactured professionally.

Collector, Furruckabad, No. 206, *dated* 29*th April*, 1870.—The Collector promises to report the result of the experiment after the tobacco is manufactured and sold.

Collector of Furruckabad, No. 374, *dated* 17*th June*, 1870.—The Collector states, that half tolah was sown on nine biswas of pucka clay, was watered fifteen times, and weeded five times. The yield was 2 maunds, 4 seers, 12 chittacks, of which 21 seers were refuse. The tobacco was sold for 9 Rupees.

From C. A. Elliott, Esq., *Officiating Secretary to the Government of the North-Western Provinces, to* H. Rivett-Carnac, Esq., *Cotton Commissioner, Central Provinces and the Berars, dated Nynee Tal, the* 21*st July*, 1870.

Sir,—In continuation of this office letter, No. 87, dated 11th June, 1869, I am directed to forward, for your information, copy of an abstract of the reports received from the several District Officers in the North-Western Provinces, giving the result of the experimental cultivation of the American James River Tobacco seed.

2. It will be observed that there seems to be no difficulty in growing the plant, but that there is no demand in the market for the tobacco produced from it, and this is probably due to the fact that its manufacture is not well understood.

3. As far as present experiments shew, this tobacco can in no way compete as to market value of produce with the tobacco grown from country seed.

List of Timber Trees and useful Plants of the Hazareebaugh Zillah Forests; communicated by M. Claude J. Dumaine.

Acacia Arabica, Wild. *(Babool, babul.)*—This well known, common, and useful tree does not seem to do well in this part of the country, and all those found here and there seem to have been put down by some of the villagers, and alongside of the Grand Trunk Road by the Department, Public Works. The bark is used for *tanning* and medicine. The *gum* is identical with *gum* arabic, which issues from the trunk and thick branches. The timber seldom is allowed to grow to a large size, and is used for cart wheels, axles, building purposes, &c., being of a fine grain and tough. Its leaves hatched up are used by shepherds and placed on sores of sheep and goats for the purpose of killing all maggots.

2. Acacia Catechu, Wild. (*Khair.*)—This tree is really wild and found almost everywhere. The wood being strong,

close-grained, heavy, and hard, is used for axles, pestles, pins, crushers for sugar-cane, and oil-mills, and out of the heart of it the *kut or khatu* is made and exported to Europe for dyeing and medicine. (See Agricultural and Horticultural Society's Journal, new series, Part IV., volume I., page 399, for mode of preparing the cutch of commerce, from the *Acacia catechu.*) In the cold weather, gum issues from its trunk by itself, in the shape of large bubbles, very transparent, and its adhesive properties are equal to that of the gum arabic.

The branches are cut down in the beginning of the rains, and made use of as fences.

3. Pentaptera tomentosa *(asin.)*—This useful tree is found all over the forest. Bark—dark, rough, and longitudinally furrowed. The leaves are made use of for silk culture, the caterpillars of *Antheraea paphia* readily take to it. The timber is reddish, tough, strong, durable, and heavy, seldom or never attacked by white-ants, and made use of for general purposes.

The bark is used by dyers and a white kind of gum is to be had from it by making incisions on the tree.

4. Grislea tomentosa, Rox. *(Dhoway darla.)*—Very common, and found especially along the creeks and holes in the jungles. Wood useless. Has a very handsome appearance when in blossom, and its red flowers (dhoway) are made use of as dye, and I hear medicine. Flowers procurable from February to end of March.

5. Casearia tomentosa, Rox. *(Cheela berry bagree.)*—Small tree; wood used as fuel only. The fruits are gathered, pounded, and put in tanks and small streams for killing fishes. They are supposed to cause the water to be unwholesome by being thus poisoned. Smooth greyish bark; leaves narrow and dark green. Procurable from February to end of April.

6. Cassia fistula *(amultus, bundur lor, bundur latee.)*—The Indian laburnum, found abundant in the forest. The timber is strong, close-grained, reddish, and is made use of for house building, &c.

The bark is used by dyers; the pulp of the fruit is used as medicine. Bark—smooth and very light grey; flowers yellow. Fruit procurable from December to February.

7. Butea frondosa (*parras dhak.*)—Very common wood; used for fuel only. Leaves given to buffaloes during the hot weather when nothing is to be had. On its branches the *Coccus lacca* (lac insect) is found. By making incisions, a fine dark-red gum issues similar to gum kino, and used as an astringent medicine, and for dyeing. Its flowers, which are procurable in February and March, are used by dyers. Charcoal is made out of its branches for making gunpowder. Fibre is made out of the roots and made into strong rope.

8. Buchanania latifolia; Rox. (*Petar, cheeronjee tree.*)—Very common. Dark bark, tesselated by furrows, into small quadrangular pieces. Sometimes the *Antheræa paphia* caterpillars are fond of its leaves.

Bark used by dyers and tanners. The kernel of its fruit, *cheeronjee,* is sold and used in confectionery I hear an oil is extracted from it. Fruits—small, black, are sold in the bazar.

A beautiful clear gum is procurable by making deep incisions on the tree, found to resemble the Bussoora gum, but superior in its adhesive properties, similar to the gum acacia. (See Agricultural and Horticultural Society's Proceedings of 18th November, volume I., part III., for report given by Messrs. R. Scott Thomson and Co., of Calcutta.) The *Antheræa paphia* is often found on this tree in its wild state.

9. Conocarpus latifolia, Rox. (*Dhow, dhoula, dhaori.*)—Handsome tree. Smooth light grey bark, very common, a well known silk-worm feeder. Timber—strong, and used for naves, axles, crushers for sugar-cane and oil-mills. Leaves used by tanners. A beautiful white gum issues by itself from the thick branches and trunk.

10. Bassia latifolia, Rox. (*Mohwa, mowa.*)—A well known common tree, and found in all the adjoining hilly districts as

well as here. The fruits or flowers are collected from February to March, before which period all its leaves have fallen. Wine is made out of its fruit, and in that case the refuse is given to female buffaloes and cows which cause them to give a larger quantity of milk, and also given to pigs and other animals for fattening them. Eaten by all classes of natives when collected from the trees and dried; some boil it and eat it with rice, others fry it, and some even eat it raw. The trees are let to the ryots from 6 annas to 1 Rupee for one year. Their produce vary from half to 2 maunds, pucka, per tree; but most part of the trees are divided amongst the ryots of the villages on which they stand, and their amount is included in the yearly rent. The people employed to gather the fruits or flowers generally get from half to one-eighth of what they collect; half of their gathering is given them when the fruit is just falling and in small quantity, and one-eighth when they fall plentifully. About the beginning of May, the new leaves make their appearance, and by the end of the month the seeds are formed and collected up to about the middle of June. Oil is extracted from them. The process is described in the Agricultural and Horticultural Society's Journal, volume I., new series, part IV., from pages 394 to 397. The flower is very heavy and kept in large baskets called *daily*, which are made to contain from 10 to 80 maunds each. They are sold from 1½ maunds to 3 maunds, cutcha, per rupee. The cutcha maund is equal to 24 Calcutta bazar seers.

The oil is sold very dear, 2½ to 3 annas per seer.

Oil-cake up to this time found of no value, and not sold about here.

The bark is very astringent and used in gargles. Wood—strong, hard, reddish. Trees not allowed to be cut. By making deep incisions around the tree, a kind of white milky gum comes out, but of no use. Found on dry rocky and high spots.

11. Diospyros tomentosa (*kaind, cheerchetree, tendu aluies.*)

—Very plentiful about this place, especially on the hills, but made use of only for building purposes. Cannot stand rain when cut down. Not used for fuel, and the heart wood, which is the real ebony, not made use of here as in Monghyr. The fruit is globular : has a sweetish, astringent, and unpleasant taste. Sold in the bazar 20 for the pice. Leaves sometimes used as dishes by natives.

12. Schleichera trijuga, Wild. *(Kossoom, gosam, gansam)*—Common and plentiful. The lac insect *(Coccus lacca)* is found on it. Red, hard, heavy wood, used for sugar-cane and oil-mill crushers, naves, axles, &c. Fruit sold in the bazar.

13. Shorea robusta *(sakooa sal.)*—A well known common tree, found in abundance all over the jungles. A well known silk-feeder. Leaves are also used for dishes; bark for tanning and by dyers. Wood—good, strong, and durable, made use of for general purposes, close-grain even fibre, and of reddish colour. Bark smooth—second best timber in India. A resin or ral *(dhoona)* exudes from its bark, which is used by Hindoos in their temples as incense, and generally collected by the lower classes of natives.

14. Semecarpus anacardium *(bhayloon.)*—The marking-nut tree, very common; smoothish ash-colour bark. Wood—soft, white, and valueless. The wood is not even burnt. Out of its nuts, ink is made, and said to be given to elephants as medicine. The oil extracted from it has a very disagreeable smell, and if any one should expose himself not only to the fumes of the oil but to the smoke of its wood, the whole body swells and remains so for days. (See Agricultural and Horticultural Society's Journal, volume I., new series, part IV., page 398, in which the method of extracting the oil from the nut is fully detailed.) The oil is put to axles, and is a very good preventive against white-ants: it is not sold; each one prepares the quantity he requires. The reddish pulpy stuff, which is below the nut, is eaten by natives.

15. Acacia speciosa *(siris.)*—Hardly ever found in the deep forest, but seems to grow on good, even ground. Grows

very fast; smooth, dark bark, and wide-spreading. The heart of the wood is dark heavy timber, durable and not attacked by insects—recommended for railway sleepers—gum oozes from its trunk, but not collected.

16. Ficus Indica *(bur, bhoot, bargad.)*—The Banyan tree is well known to all, and found almost very near the villages as well as in the jungles. The wood is made into hill-cart (ságur) wheels, which are in three pieces, and last, generally, two years. Mortars and plates or dishes are also made out of it, and I made once a sugar-cane mill out of a thick branch, which has lasted two years already, and will last four to five years more, if taken care of, and not allowed to remain in the mud or exposed to the rain. Its leaves are here eaten by elephants, but could be made use of in a more profitable way if the species of *Antheræa* who feed on its leaves in Assam and Cachar was brought from there. The milky sticky stuff which comes out from its branches is mixed with peepul milky stuff, and bird-lime is made out of it with oil. The lac insect *(Coccus lacca)* is said to take to its ~~branches,~~ like the *parras, (Butea frondosa)*; but no one seems to take that trouble.

17. Ficus religiosa *(peepul.)*—Not common in the forest. The timber, leaves, &c., is made use of as the Banyan tree, *(Ficus Indica)* the Bombyx religiosœ of Helfer, is said to feed on its leaves, but are not known here. The lac insect thrives well on this tree.

18. Ficus glomerata *(goolar, gúlar.)*—This tree is found generally on the sides of rivers, creeks, and damp places in the forest, as well as near the villages.

The fruit is greedily eaten by bears, monkies, and even by men, who make curry, &c., and even eat it when perfectly ripe.

I made (ságur) hill-cart wheels out of it, but although it does not readily decay under water, it does not seem to be ever cut down but for fuel.

19. Ficus infectoria, *(punkur, pakur.)*—Of very little use, seldom cut down, but for fuel, and no use is made of its roots—worthless tree altogether.

20. Melia Azadirachta, Azadirachta Indica *(nim, neem.)*—This well known tree does not seem to be wild, but found planted in the villages. With the exception of its leaves, it is never taken notice of or ever cut down. No idols are manufactured out of its bitter wood as in Bengal.

21. Carissa carandas *(karonda.)*—A shrub common all over the forest. Its fruits are collected and sold, and out of its branches temporary fences are made—wood useless.

22. Terminalia bellerica, Rox. *(Baheera, buhair, myrabolans.)*—A large tree with bark tesselated by longitudinal and transverse furrows and cracks ;—very common. The fruit is collected about February and March and used for dyeing and tanning. They are, when green, eaten by cattle. I am not aware that the tree is ever cut down but for fuel.

23. Terminalia chebula, Retz. *(Harr, karra, myrabolans.)*—To be found almost everywhere. The fruit is collected and used medicinally and for tanning purposes, and procurable from June to end of July. Timber of not much value. Ink is also made out of its fruits.

24. Emblica officinalis, Gaert. *(Onrah, areila, amla, myrabolans.)*—A very common ash-colored bark and found all over the forest. Wood of no value here, although it is said to be durable under water.

The leaves and fruit are used by tanners, and the latter for ink manufacturing, and I am given to understand used medicinally. It is gathered about January and February—greedily eaten by cattle, and men as well. I hear pickle can be made out of the fruit, which is its principal produce.

25. Bombax heptaphyllum, Cav. *(Semal, seemhul.)*—A very common tree, and has beautiful showy red flowers : it has an enormous buttressed trunk. Timber cut down for planks, and canoes are made out of the tree itself. The flower is eaten by

the buffaloes. About February and March, an astringent gum exudes from the bark and is collected and used for diarrhœa, &c. Its silky cotton is collected yearly, and the man who does it, keeps one-third of his collection for his trouble, and the remaining two-thirds are given to the right owner of the tree (landholder.)

26. Tamarindus Indica, *L. (imli.)*—The tamarind tree is found only in the villages. Those met with in the jungles must have been put down. The fruit is its principal produce, used for food and medicine.

The timber is finely-veined, hard, heavy, and strong, and is applied to various uses for making naves, clod-crushers, and used in sugar-cane and oil-mills.

(To be continued.)

The Gardener's Note Book, No. 13.

Hints for the successful cultivation of Hyacinths and other Bulbs in Calcutta; by Archibald Rogers, Esq.

The bulbs ought to reach this country by the middle of October, and should be at once planted in flower-pots, filled with a mixture of leaf-mould, sand, and common garden earth. I have, on several occasions, had bulbs sent out from England by parcel post, in a loose bag, each bulb wrapped in a separate piece of water-proof cloth, and they have always arrived in perfect order. As soon as the first green shoots show themselves above ground, the flower pots should be covered during the day with bell glasses, or inverted lamp shades, having the socket ends well corked, and should be kept during the day close to the north wall of the house, so as to get no sun. After sun-set, the glasses should be removed, and the plants exposed to the dew and radiation until seven or eight o'clock on the following morning. If the flower shoot is slow in rising out of the bulb, after making its appearance, its growth may be accelerated by standing the

pot a few inches deep in water. By the above means, I have been very successful with hyacinths, and have got one tulip to flower; and the same treatment applies equally well to narcissi and jonquils.

Alipore, 20th March, 1870.

On the propagation and culture of ornamental Shrubs, Climbers, Creepers, Perennial plants, and Fruit trees, by means of layers, division of roots, budding, ball graft, &c., during the rainy season.

The preparation of the following papers has been suggested, as a companion to the paper on the propagation of shrubs, &c., by means of cuttings, (Journal Part 1, Vol. 2, new series,) and will prove useful in extending the culture of such kinds given in the lists, which either do not seed, or cannot be depended on if raised from seed.

Selected list of Shrubs and Trees capable of propagation by layers, division of roots, and gooties, (ball graft,) during the rainy season.

Allamanda neriifolia	...	By layers.
Amherstia nobilis	...	" layers.
Astrapæa Wallichii	...	" layers.
Bambusa, of sorts	...	" division.
Brunfelsia, of sorts	...	" layers.
Catesbœa spinosa	...	" layers.
Cerbera fruticosa	...	" layers.
Crescentia cujete	...	" layers.
Cryptomeria Japonica	...	" layers.
Cupressus, of sorts	...	" layers.
Dombeya, of sorts	...	" layers.
Erythrina, of sorts	...	" gooties and layers.
Filicium decipiens	...	" layers.
Franciscea, of sorts	...	" layers.

Gardenia lucida	...	By layers.
Ginora Americana	...	,, layers.
Ilex Paraguayensis	...	,, layers.
Ixora, of sorts	...	,, layers.
Jacquinia ruscifolia	...	,, layers.
Jasminum, of sorts	...	,, layers.
Juniperus, of sorts	...	,, layers.
Lagerstromia Indica	...	,, layers.
Lemonia spectabilis	...	,, layers.
Magnolia, of sorts	...	,, layers and gooties.
Murraya exotica	...	,, layers.
Mussænda frondosa	...	,, layers.
Myrtus communis	...	,, layers.
Nerium odorum	...	,, layers.
Olea fragrans	...	,, layers.
Olea myrtifolia	...	,, layers.
Rondeletia puniсea	...	,, layers.
Swietenia mahagoni, (mahogany)		,, layers.
Talauma pumila	...	,, layers.

Selected list of flowering Plants easily propagated by layering grafts and division of roots, during the rainy season.

Aloysia citriodora	...	By layers.
Anemone Japonica	...	,, division.
Bæhmeria nivea	...	,, division.
Chrysanthemum, of sorts	...	,, division.
Crinum, of sorts	...	,, division.
Dahlia, of sorts	...	,, division.
Euphorbia jacquiniflora	...	,, layers.
Gesneria, of sorts	...	,, division.
Gloxinia, of sorts	...	,, division.
Hydrangea, of sorts	...	,, division.
Russelia, of sorts	...	,, division and layers.
Solidago canadensis	...	,, division.
Verbena hybrida	...	,, division.

Viola odorata, sweet violet	...	By division.
Bulbs	...	„ division.
Ferns	...	„ division.
Roses	...	„ budding, grafting, and layering.

Selected list of creeping and climbing Plants capable of being propagated by grafting, division of roots, layering, budding &c.

Allamanda, of sorts	..	By layers.
Akebia quinata	..	„ division of roots.
Argyreia, of sorts	..	„ layers.
Aristolochia, of sorts	..	„ layers.
Asparagus racemosus	..	„ division of roots.
Bannisteria laurifolia	..	„ layers.
Beaumontia grandiflora	..	„ layers.
Bignonia, of sorts	..	„ layers.
Bougainvillea, of sorts	..	„ layers.
Cœsalpinia Grahami	..	„ layers.
Ceropegia Garderi	..	„ layers.
Chrondrospermum dentatum	..	„ layers.
Combretum, of sorts	..	„ layers.
Congea tomentosa	..	„ layers.
Cryptostegia grandiflora	..	„ layers.
Dalechampia Madagascarensis		„ layers.
Echites, of sorts	..	„ layers.
Frederickia Guilelmi	...	„ layering or grafting on Bignonia stock.
Gloriosa superba	..	„ division of roots.
Hiptage madablota	..	„ layers.
Jasminum, of sorts	..	„ layers.
Lonicera, of sorts	..	„ layers.
Macfadyena (Bignonia) uncinata		„ division of roots.
Manettia cordifolia	..	„ layers.
Parsonsia corymbosa	..	„ layers.

Passiflora, of sorts	...	By layers.
Petræa volubilis	...	„ layers.
Plumbago capensis	...	„ layers.
Poivrea coccinea	...	„ layers.
Poivrea grandiflora	...	„ layers.
Rhyncospermum jasminoides	...	„ layers.
Roupellia grata	...	„ layers.
Stephanotis grandiflora	...	„ layers.
Stigmaphyllon periplocifolium		„ layers.
Tecoma, of sorts	...	„ layers.
Thunbergia, of sorts		„ layers.
Unona laevigata		„ layers.
Wisteria sinensis		„ layers.

Selected list of Fruit Trees capable of propagation by layering, grafting, and budding.

Apples, (Pyrus malus)	...	By layers.
Avocadopear, (Persea gratissima)		„ layers and [illegible]
Bâer, (Zizyphus jujuba)	...	„ budding on common baer stock.
Bael, (Ægle marmelos)	...	„ grafting on common bael seedlings.
Banana, (Musa sapientum)	...	„ division of roots.
Bullock's heart, (Anona reticulata)		„ layers.
Cherimoyer, (Anona cherimola)		„ layers.
Citron, (Citrus media)	...	„ grafting on seedling citron and gooties.
Custard-apple, (Anona squamosa)		„ layers.
Fig, (Ficus carica)	...	„ layers.
Granadilla, (Passiflora edulis)	...	„ layers.
Guava, (Psidium)	...	„ layers.
Jamrool, (Jambosa alba)	...	„ layers.
Kuronda, (Carissa carandas)	...	„ layers.

Lemon, (Citrus limonium) ...	,,	grafting and budding on *lime seedlings and* gooties.
Litchee, (Nephelium lichi) ...	By	gooties.
Lime, (Citrus acida) ...	,,	grafting and budding on lime seedlings and by gooties.
Long plum, (Zizyphus vulgaris)	,,	budding on Zizyphus seedlings.
Loquat, (Eriobotrya Japonica)	,,	gooties.
Mango, (Mangifera Indica) ...	,,	grafting on mango seedlings and by gooties.
Olive, (Olea) ...	,,	layers.
Orange, (Citrus Aurantium) ...	,,	gooties and grafting on orange seedlings.
Peach, (Amygdalus Persica) ...	,,	grafting and budding on peach seedlings.
Pear Dessert, (Pyrus communis)	,,	grafting and budding on pear seedlings and by layering.
Pine-apple, (Ananassa sativa)	,,	division of roots.
Pomegranate, (Punica granatum)	,,	layers.
Pummelo, (Citrus decummana)	,,	budding and grafting on seedling pummelo and gooties.
Rose Apple, (Jambosa vulgaris)	,,	layers.
Sapota, (Achras sapota)	,,	grafting on sapota seedlings and by layering.
Strawberry, (Fragaria vesca)	,,	division of roots.

Notes on Horticulture in Bengal, (No. 1)—By JOHN SCOTT, ESQ., *Curator, Royal Botanic Garden, Calcutta.*

No. 1. GERANIACEÆ—THE CRANES-BILL ORDER.

1. *Geranium.*—The Cranes-bills (from *geranos*, a crane; in allusion to the crane-like beak of the carpels) are distinguished from their congeners, by their regular flowers, ten stamens, and five carpels, each tipped by a long, smooth, and ultimately recurved awn. They are annual or perennial herbs, rarely undershrubs, found in all temperate climates, and the tops of mountains in the Tropics. They have palmately-lobed or divided leaves, and one or two flowered peduncles, with usually large and beautiful flowers, of various hues. None of the herbaceous perennial species have as yet been grown with anything like success in Lower Bengal. In the Botanic Garden, I have over and over again raised several species, *e. g., G. Aconitifolium, Anemonifolium, pratense, &c.*, which grew with exceeding vigour during the cold weather, became sickly in the hot; and the few that survived this, lived but to die in the rains: not one have I ever kept in life from the one cold season to the other, nor can I hear of others being any more successful. Several of the annual species, on the other hand, are of easy culture, and readily flower in the open border. The seeds of these should be sown in pots in October, and the seedlings either wholly or in part pricked out in the open border on a compost of loam, vegetable mould, and sand: a few might be retained for pot culture in the verandah. They will generally flower in February and March. The species which I have grown and flowered here are *G. lucidum, molle, Robertianum, rotundifolium* and *nepalense:* the latter, indeed, is partially naturalised, and springs up in the grass conservatories, from self-sown seed. It is a pretty little species with 5-lobed leaves, and flowers of a reddish-purple, with a darker colored eye on elongated pedicels. Though flowering the first season from seed and

always succumbing to the hot or rainy season in the open borders, it may, under pot-culture, be kept for two or even three years.

2. *Erodium.*—The Herons-bills, from *erodios*, a heron, and so called from the resemblance of the seed-pod to the head and beak of that bird. They are technically distinguished, by having five of their ten stamens sterile, awns of the carpels bearded, and ultimately coiling up in a spiral manner. The annual species require similar treatment to that recommended above for the geraniums. The species which have flowered in the Botanic Gardens here are *E. cicutarium*, a species with hairy procumbent stems, pinnate leaves, and rose-coloured flowers. *E. gruinum*; this has an erect stem, ternate leaves, and bluish-purple flowers. *E. maritimum* with prostrate, spreading hairy stems, cordate leaves, and small pale-red flowers. *E. moschatum* has pinnate leaves, viscous many-flowered peduncles of rose-coloured flowers; as denoted by the specific name this plant has a powerful musky smell.

3. *Pelargonium.*—The Storks-bill, from *pelargos*, a stork, from some fancied resemblance in the capsules to the head and beak of a stork. This is a very large genus of which the species are almost entirely confined to the Cape of Good Hope. In gardens they are generally called geraniums, though entirely distinct from these plants, and easily recognised by their spurred calyx, adnate to the flower-stalk, more or less irregular corolla, and number of fertile stamens, which vary from four to seven. Of this vast genus there are only a very few at all manageable in Lower Bengal, and even of these there are only some five or six sorts which ever produce a bloom, and of these the *P. zonale* and one or two of its varieties with the *P. Inquinans* are, however, the only free bloomers; nor do they appear to be any more disposed to this —as many other plants are—when raised from seed grown in Upper India. The pretty gold and silver leaved tri-color-pelargoniums are yet unknown in our gardens: plants in-

deed of several of the finer sorts have been tried, but these arriving late in the cold season, were not well established before the setting in of the hot season, during which all died. * From a batch of seedlings, however, which I have lately raised from the finest kinds, I am hopeful of getting some really good sorts: as the foliage of some of them are already showing distinct bronzy colored zones on a pale yellowish ground. The soil or conditions of life, however, seems from Mr. Beaton's experience (" he having raised at Shrubland, during six years, 20,000 seedlings from the Punch Pelargonium and not one had variegated leaves; whereas at Surbiton, in Surrey, one-third, or even a greater proportion of the seedlings from that variety were more or less variegated,") to have a very decided effect on the colouring of the foliage, so that, even should we fail in raising in the first instance, tri-color forms from imported seeds, success may very probably result from an experiment with seed saved from those plants: given the constitutional tendency and favourable vegetative conditions (both of which we have in those seedlings) "and "there is no reason why the peculiarities should not be again developed in the progeny. †

The management of those species at all suited to the climate is by no means difficult: certainly they require more care

* Mr. G. Bartlett has lately, December, 1870, introduced a few plants of the newer tri-color-leaved varieties; and these, though as yet but of weak growth, exhibit the characteristic colouring of the leaves which not one of several young plants of really good sorts introduced in the Botanic Gardens here in 1869, did: the foliage being simply that of the older silver and golden-leaved sorts. Mr. H. R. Cooke, Deputy Registrar, Foreign Department, informs me that he has successfully introduced several of the tri-color-leaved sorts to Simla, and I also hear from Mr. McIvor that they thrive remarkably well in the Ootacamund Gardens.

† As illustrating this remark, I may state that some very distinctly marked silver and golden-leaved varieties have been raised in the Botanic Gardens here from seeds of the common zonale sorts, grown in Simla, and contributed to the Gardens of Mr. C. Macleod, Registrar of the Foreign Department.

than many of our other favourite plants, and would not for example survive on a water-gorged border in the rains: not, however, of the heavy rain-falls, and accompanying heat would they die, but simply because of the stagnating water; and on a raised and thoroughly drained border pelargoniums endure the rains as well as many of the other so-called hardy plants. I have at least found it to be so with *P. Zonale* and *inquinans*; the other species require a little more care. They should be kept in an open airy verandah (an eastern exposure is the best, where they get the morning sun only) during the hot season, and the growth checked as much as possible by giving only water in sparing quantities when the soil is really dry, and the leaves disposed to flag. Shoots formed in the hot season are generally weak and sickly, and will usually damp off or rot in the rains, infecting also the hardened shoots, and ultimately cause the destruction of the whole plants. The soil best adapted for the pot-culture of these plants is about three parts of light loam and vegetable mould to one of sand, pieces of charcoal, and kanker. With a free and porous compost of this nature (in a well-drained pot to carry off all superfluous water, and admit an abundance of air to the roots) there will be no difficulty in keeping pelargoniums in a thriving condition. They are readily propagated by cuttings under bell-glasses during the cold season; which is also the best period to raise them from seed. It is to be regretted that so little care should in general be bestowed by cultivators here, on the training and pruning of these plants: which with the exception of huddling together and binding to a stick a few sprawling branches on an overgrown and really ugly plant (whose only redeeming quality is that it is a geranium) all else is left to nature. Now all that is necessary to remedy this is to apply the knife freely in the beginning of the cold season, cutting back every shoot, so that where one sprung before several will then be produced, and thus by repeated stoppings of the shoots, a neat symmetrical and bushy plant

will be the result, which even, in the absence of flowers, will really be an ornament to the verandah.

The following kinds may be found in the gardens of Lower Bengal : *P. balsameum,* balsam-scented storks-bill which may be distinguished by the palmate, sweet-scented, somewhat rough and hairy leaves, with wavy irregularly crenated margins ; flowers pale red, in few flowered umbels. *P. capitatum,* has diffuse stems, hairy, heart-shaped fragrant leaves, waved and toothed at the margin ; flowers of a pale-purple colour in many flowered umbels. *P. crispum* has all its parts more or less softly-hairy, the leaves diffusing a not unpleasant balmy odour, and arranged in a somewhat two-ranked manner on the stem ; the flowers are of a rosy-purple colour and usually two together. This is popularly known as the curled leaved storks-bill, and by the native malees as the *Baum-geranium :* though I rather think they use the term indifferently to any sweet-smelling leaved pelargonium. *P. cucullatum,* leaves kidney-shaped, somewhat hooded, and hairy ; flowers of a purply-red with darker veins, on a five-flowered umbel. *P. hybridum,* has a strong resemblance to *zonale,* though distinguishable by its roundish, crenated, spotless leaves, and narrow, wedge-shaped petals ; the flowers are of a scarlet colour, on many flowered peduncles. *P. inquinans* is a lovely and free flowering species, producing its bright crimson or scarlet flowers in great umbels—at times from 60 to 80 flowered, nearly throughout the cold season, and the beginning of the hot. In foliage it resembles much *P. zonale.* *P. lateripes,* the ivy-eaved storks-bill, a well known and favourite plant ; of a rambling, or trailing habit, well adapted for training on ornamental props, in the form of cones, pyramids, &c. It has round fleshy branches, cordate five-lobed leaves, and many-flowered umbels of pale purple flowers: there are four varieties of this plant, besides many hybrid forms. *P. peltatum,* a species resembling in general habit the ivy-leaved and always passed as such by the mallees : it is easily distinguished, however, by its angular

shoots, peltate, (*i. e.*, shield-like, or with the footstalk fixed within the margin) five-lobed entire leaves, and few-flowered umbels. The flowers are of a pale-purple colour : this is commonly known as the peltate-leaved stork-bill. *P. ribifolium*, is an erect-growing, shrubby stemmed species, and throughout more or less rough textured and hairy; the leaves are fragrant, large and heart-shaped, and the flowers (which it has not yet produced here) of a rosy-white colour, borne on many flowered umbels: it is called the currant-leaved storks-bill. *P. vitifolium*, has an erect stem, heart-shaped, scabrous, saw-edged leaves; rose coloured flowers striped with dark purple in the two upper petals, and borne on many flowered umbels: it is the vine-leaved storks-bill. *P. zonale*, is the horse-shoe storks-bill, a favourite plant, and the origin through many complex crosses of those beautiful silver, gold, and tricolor-leaved sorts, which now form one of the chiefest ornaments of the parterre garden in Europe. The normal form is distinguished by its cordate, orbicular, scarcely-lobed leaves, zoned above and toothed at the margin; wedge-shaped petals, and many flowered peduncles: the flowers vary from white, to rose, scarlet, and red. The gold and silver forms known as the *Golden Chain*, with variegated yellow and green foliage, and the *Flower of the Day* with green disc and broad silvery margined leaves, are occasionally met with in Calcutta, but so far as I can hear, they have as yet proved but fugitive treasures: introduced about the commencement of the cold season, struggling paralytically through the hot, and rarely surviving a single rainy season.

4. *Tropæolum.*—Nearly all the species of Indian Cress are showy, and well deserve a place in the flower border: the species are of annual and perennial duration, and of climbing or trailing habits. None of the perennial species have ever been successfully cultivated in the plains; several of them which I have raised from seeds, have grown vigorously

enough in the cold season, but on the approach of the hot season, they gradually began to assume a sickly look and died one and all ere its close. The annual species should be sown about the middle of October either in pots (which is the safer mode with the finer varieties) or on their permanent sites in the open border. As the Nasturtium delights in a rich light soil, a dressing of well-decayed cow manure, and vegetable mould should be given to the border on which it is purposed growing them. The commoner trailing varieties of Nasturtium produce seed in abundance in our gardens, which should be saved and stored with care; the dwarf Tom Thumb varieties on the other hand yield it in general very sparingly. *T. Lobbianum, majus, minus,* and their varieties, and hybrid forms, do all well here, and indeed form the chiefest ornament of our borders from the close of December till end of February. The flowers as well as the leaves of these plants are frequently used as salads, and resemble not a little those of the garden cress, whence the common name of Nasturtium, or Indian Cress. The seeds are also pickled when young, and used as a substitute for capers. In addition to the above, the *T. aduncum,* (known also as *T. peregrinum*) the Canary-bird flower, or fringed flowered Indian Cress, is also occasionally seen, but it very rarely can be induced to flower, and always dies off at the commencement of the hot weather.

5. *Limnanthes.*—A small genus of Californian annuals of dwarf habit, and with white, rose or yellow flowers. They thrive best when sown where they are to remain, which should be on a small shady border. The *L. Douglassi* is a neat little herb with spreading stems, pinnate leaves, and axillary flowers of a white colour, with a bright yellow centre. There is a variety of this called *alba,* differing only in having uniform white flowers.

6. *Oxalis.*—The Wood sorrels are very numerous, and largely represented in tropical America and the Cape of Good

Hope. They have nearly all showy flowers, and are of the easiest cultivation, thriving well in the open border, if the drainage is effective. They are most impatient to water stagnating about their roots, and if subject to this through a rainy season they will assuredly be lost. The seeds of the annual species may be sown either in pots or the open borders (they do not suffer from transplanting if it is done with care) in October, and they will be in flower early in January and continue till about the middle of March. For the pot-culture of the wood-sorrels the bulbs must be potted in October in a mixture of light loam, vegetable mould, sand, and kanker: they will require no water until the young shoots make their appearance above the soil. At the end of their flowering period, in April, gradually reduce the quantity of water, until they have naturally passed into a dormant state, as shown by the drying up of the foliage, when it must be altogether discontinued. In this state they may be allowed to remain in a dry airy and shady situation for a month or so, and then finally stored for the rains. For the finer and scarcer sorts, the bulbs should be taken up and kept in bottles amongst dry sand, whereas those of which there is an abundance, may be stored in any dry, airy shed, until the return of the cold season—care only being necessary that they be brought out and exposed as they again spring up. The lank and pallid shoots which they produce, when neglected for a short time at this period, will cause them to flower much less freely.

The species in cultivation here are *O. Bowii*, a hoary, stemless species, of great beauty when in full flower, with its large pale crimson blossoms, disposed on many flowered umbels, and presenting a pleasing contrast with the rich green of the tri-foliate leaves : it is a native of the Cape of Good Hope. *O. bipunctata*, has lilac colored flowers with pinkish veins; on many-flowered panicles, and leaves of three broadly obcordate leaflets, hairy below and smooth above: it is a native of

Brazil. *O. carnosa,* has a short, scaly stem and, as well as the leaves, fleshy; flowers yellow on a few flowered scape: a native of Chili. *O. cernua,* is an almost stemless species, with leaves of three somewhat two-lobed leaflets and many-flowered umbels of showy, bright yellow flowers: a native of the Cape of Good Hope. *O. corniculata,* a weedy little plant, and an indigen of Bengal, noticed here only as also occurring in the South of England and various other parts of Europe as well as in America. It is the Amrool of the Bengalees. *O. Deppei,* stemless; leaves of four leaflets, hairy and glaucous beneath; flowers of a coppery red colour, on many-flowered umbels: a native of Mexico. *O. filicaulis,* stem naked at the base; decumbent, leaves two-lobed, smooth; flowers violet colored: a native of the Cape of Good Hope. *O. flabellifolia,* nearly stemless, with leaves of 6 to 9 narrow leaflets, flowers yellow: a native of the Cape of Good Hope. *O. flava,* has an erect, naked stem, with leaves of 6 to 7 linear, channelled leaflets; flowers yellow, on stalks longer than those of the leaves: a native of the Cape of Good Hope. *O. floribunda,* flowers reddish, marked with darker veins; leaves arising from the root, consisting of three roundish leaflets: a native of Brazil. *O. lanata,* stemless and wooly; flowers white, on scapes longer than the leaf stalk: a native of the Cape of Good Hope. *O. multiflora,* has a much branched, leafy, erect stem and lilac flowers, on peduncles much longer than the leaves: a native of the Cape of Good Hope. *O. pentaphylla,* has leaves of five leaflets, a somewhat erect stem, and rose-colored flowers: a native of the Cape of Good Hope. *O. polyphylla,* has a slightly branched stem, three linear leaflets, and pale-red flowers. *O. rosacea,* leaflets three, oblong; the stem decumbent; flowers a deep-red, with yellowish centre: it is a native of the Cape of Good Hope. *O. rosea,* flowers rose-colored, on forked racemes, from an erect, fleshy stem: a native of Chili. *O. rubella,* has a purplish corolla, with a yellowish centre, and a leafy, erect, branching stem: a native of the Cape of

Good Hope. *O. speciosa*, stemless, with roundish leaflets, rosy-purple flowers and erect scapes: a native of the Cape of Good Hope. *O. variabilis*, stemless, with roundish leaflets and rosy-purple flowers: a native of the Cape of Good Hope. *O. versicolor*, flowers white inside and pale-red outside; stem procumbent, leaves of three linear leaflets: a native of the Cape of Good Hope. *O. violacea*, a stemless plant, with leaves of three obcordate leaflets; flowers erect, pink-colored, on a 3 to 9 flowered umbel: a native of Carolina. *O. tetraphylla*, flowers of a purplish-violet colour, on 5 to 10 flowered umbels, leaflets four, glaucous beneath: a native of Mexico. *O. sensitiva, the* Bun-nurunga, of the Bengalees: an interesting little indigenous plant, abundant everywhere in the rains, and like *Mimosa sensitiva*, its leaflets collapse on being touched. The flowers are yellow coloured in umbels, on stout peduncles, and the leaves are pinnate, consisting of fourteen pair of leaflets.

7. *Impatiens.*—An extensive genus of annual and biennial herbs, with stout fleshy stems, swollen at the joints; with curiously-formed, and often very showy flowers. They are chiefly Indian plants, though a few are found in Africa, Europe, and America. Many of the Himalayan species are of great beauty, but only a very few of those that we have as yet tried, can endure the heat of the plains: nearly all plants that delight in moist temperate conditions, our seasons ill-suit them. Thus, seed germinating here in the cold season have just commenced flowering when the hot weather sets in and destroys them; again, the rainy season succeeded, as it is by the cold, may be thought suitable, and here the difficulty is that the seeds germinate badly and produce weak, sickly plants, which rarely acquire any strength and generally die off before the end of the rains. There are, however, a few of the species from the moister tropical vallies fairly adapted to culture in the plains, and generally flower freely, though rarely producing a single seed: two only have become partially

naturalized. My experience, however, is yet confined to a few of the Sikkim species, and probably there may be many others which will thrive here, and the host of beautiful Khasian species will, doubtless, afford some that can be cultivated in our grass conservatories. The common balsam is one of our most useful garden annuals, and may be had in flower by successional sowings nearly the whole year. Thus sowing in October, they will be in perfection by the middle of December (small plants certainly compared with those grown in the rains only 10 to 12 inches high, but a mass of bloom) and continue flowering until the beginning of February. If planted on rich open soil and liberally watered, not one of the cold season annuals will make a more effective display than a closely-set group of balsams. As a succession to those, [illegible] sowing should be made in February: these will flower in March, and if the beds on which they are grown be regularly and well irrigated, they will last till June. At the commencement of the rains, an abundance of self-sown seedlings will spring up in beds where the balsams have been previously grown, and prove very useful for filling up blank beds, &c.: these will flower in August, and continue blossoming until the end of the rains. A fine display of balsams may also be got up for the conservatories in the early part of the cold season when there is a general scarcity of bloom. For this purpose seeds should be sown in August in pots, and the seedlings potted off separately : first in small pots, and as they fill these with roots, into larger, picking off the flowers in the earlier stages of their growth to give greater vigour to the plant; flowering them in five-inch pots, and at every re-potting, sinking the stem to the lower leaves.

It has been remarked, that balsams rapidly degenerate in this country, and that the "seedlings which come up self-sown, each succeeding season, will be weedy, worthless plants," and let me add, so are they when thus raised in Europe. One year's old seed, high in vegetative activity, produce large over-

grown plants, with single or semi-double inferiorly coloured flowers; whereas the same seed when kept for four, or as it is, even eight years, the progeny will be nearly all double-flowered, and of great variety of colour. What then may we expect in India, where the seed, as in the case of the self-sown progeny, has just fallen from the plants and at once started into vegetative activity? Certainly, we need not be surprised to hear of rapid falling off in the quality of the bloom. Lindley in his Theory of Horticulture, after referring to somewhat similar results in the common ten-week stocks, thus explains the phenomena, "we say that in keeping a seed for several years, we fatigue and weaken it. Now when we place it in a suitable soil, we change its natural state, and from a wild plant make it a cultivated one. What proves our position is that plants, in their wild state, shedding their seeds naturally, and sowing them as soon as they fall to the ground, yet in a long succession of time scarcely ever produce plants with double flowers. We think, then, after what we have said, that whenever a gardener wishes to obtain double flowers, he ought not to sow the seeds till after having kept them for as long a time as possible." With regard to the time that balsam seeds may be kept in this country, without losing their germinative powers, I have no certain information. If thoroughly ripened seeds, however, be in the first instance secured, properly dried and stored in well-corked bottles, opened say once or twice a year (the beginning of the cold and the end of the hot season) and exposed in a dry airy verandah, I do not doubt that they will retain their vitality several years. Anyhow, it is natural to suppose that the same results may be had from seeds of Balsams, Chinese pinks, Zinnias, and the like, by keeping them for about half the time they find it necessary to do in Europe. So far as known, all that is required is to reduce the vital energy, and this of course can be effected much more quickly, by the unnatural mode of treatment suggested, in a tropical than in a temperate clime. It is, indeed,

not at all probable to me, that those results might be at once effected by judiciously subjecting the seeds to such chemical agents as have a tendency to reduce vegetative activity. Any-how, I should think that the desired results might be effected in at least half the time required in Europe. Reflecting on these results it is interesting to further note the sterilising influence exercised by the rapid and unnatural raising of successive progeny. Thus, take balsams or zinnias with double flowers, and sow the seed as soon as ripe; which by way of illustration we will suppose to be in August, these will at once germinate, grow up, flower, and seed by November, and produce amongst a predominance of single, a very small number indeed, of even semi-double flowered plants. This, however, is the only visible difference, they flower and seed freely. From these seeds a third generation must be at once raised (an easy matter with balsams less so in the case of zinnias, which, as I have elsewhere noted, germinate but very indifferently from country-grown seed in the cold weather, even though it is then gathered), which germinate freely, the progeny of which will be very much more vigorous than those raised at the same time from English seeds; but mark the difference; in the latter, the plants are literally studded with large double blooms, whereas, in the former, the flowers are single, chiefly on the upper part of the shoots, nearly all of a uniform red or white colour, and very sparingly produced, and there is also an evidently decreased fertility, *i. e.*, in the number of seed in the capsules. From these seeds a fourth generation is again raised in January, the germination of which is tardier than in the previous experiments, probably due, however, to the low temperature of this month, though the seedlings look healthy, and push away vigorously in February. In the latter part of the month, they flower again, all still producing perfectly single blooms, most markedly confined to the tips of the branches, and producing seed capsules, in which a very large percentage of the seeds are abor-

tive. At this stage my experiments were interrupted by the seeds having been accidently mixed with other balsam seeds. I shall, however, take an early opportunity of re-testing and completing these experiments, which seem to me to have a very high theoretic interest attached to them; inasmuch as showing how short-lived, humble growing plants may, probably, attain perennial characteristics and gigantic proportions, and doubtless regain the reproductive qualities. Now, reflecting on the theory of descent with modification, on the genealogical relations of the whole Vegetable Kingdom, we are naturally led to enquire into the causes for the physical superiority, or the mere bulk differences of organisms. The struggle for existence as explained by Mr. Darwin in treating on the origin of floras in Oceanic Islands, where he tells us that an herbaceous plant, though it would have no chance of successfully competing in stature with a fully developed tree, when established on an island and having to compete with herbaceous plants alone, might readily gain an advantage by growing taller and taller and overtopping the other plants. If so, natural selection would often tend to add to the stature of herbaceous plants when growing on an Oceanic Island, to whatever order they belonged, and thus convert them first into bushes and ultimately into trees. "Origin," 3rd Ed., p. 423. In my opinion, however, there must be other impelling causes than the struggle for existence aided by natural selection; which as it appears to me would rather be productive of intertwining or climbing plants than those of an arborescent character. On the other hand, when we look to the results of changes in the physical conditions, under which any particular species will live and grow as indicated by the above experiments, we can understand how seeds of an annual plant, wafted or carried from a region subject to extremes of temperature, to an island of equable temperature, might by giving origin to several successive generations annually, and each generation gaining in vegetative vigour by the subordination of the exhaustive repro-

ductive faculties, thereby extending individual life, until, by a mayhap, temporary suppression of those organs, herbs of small size lived and grew into bushes of considerable size, and in due course give rise to a more and more gigantic progeny. Thus as it appears to me, may the humble short-lived herb, be genealogically related to the most gigantic of our forest trees: that in short herbs of low stature and fugitive life, have thus—through successive modifications, or the accumulating in bulk and durability "from generation to generation by the survival of the fittest"—given rise to those other forms which we call shrubs and trees.

The species cultivated from time to time in the Botanic Gardens here are: *I. balsamina*, the common garden balsam, which has lanceolate, saw-edged leaves; flowers several together, with the spur of the corolla shorter than the flower. There are many fine varieties of this plant with single and double flowers in a variety of colours—white, rose, red, crimson, and purple, self-coloured or variously striped and blotched. The best of them are the *Camellia-flowered balsams*, (with large double, beautifully imbricated flowers spotted with white, like some of the Camellias for which in a bouquet it might well pass); the *rose-flowered balsam*, (with very double blossoms, and large rose-like petals); there are also dwarf varieties of both of the above in some eight to twelve distinct shades and colours, mimicking not a little a flaked carnation. Besides these, there are the splendid so-called Solferino balsam, striped and speckled with lilac and scarlet, on a satin white ground; and the Victoria balsam spotted and striped with brilliant salmony scarlet, on a white ground. *I. glanduligera* is a magnificent species from Cashmere, attaining the height of 12 feet. It is an annual plant, with leaves in ternate verticels, curious glandular hairs near the bottom of each leaf, and round club-shaped stipules, just below them bearing similar glands. The flowers are showy, of a deep purple, spotted interiorly with red on a yellowish ground. The plants which

I raised in the Botanic Gardens here of this species from English seed, did not exceed 3 feet in height. *I. tricornis*, a Himalayan species, with alternate, lanceolate, saw-edged leaves, and flowers of an orange yellow, spotted interiorly with reddish spots, on a rosy-yellow ground. *I. discolor*, a Sikkim species, with showy flowers, yellow with a bronzy colored interior; the leaves are smooth, dark-green above and glaucous beneath. *I. fulva*, this is an American plant with dark-yellow flowers, spotted red in the inside, and broadly-ovate leaves. *I. latifolia*, a North Indian plant, with showy pale red flowers, and ovate, crenated, hairy leaves with single flowers in the axils. *I. leptoceras*, is a Sikkim plant, with pretty yellow and slightly fragrant flowers, on axillary racemes; ovate-lanceolate leaves, and a stout erect swollen-jointed stem. *I. puberula*, another lovely species from Sikkim, with large purplish flowers, and ovate-pointed, opposite leaves. *I. nolitangere*, the Touch-me-not, a British species, so named for the marked way in which it, as well as the other species, disperses the seeds when ripe. This may be raised from imported seed and flowered in the cold season, but I have never seen it yield seed here. *I. trilobata*, a Sikkim plant, and now partially naturalised in this garden: it has yellow flowers, usually four together, and oblong lanceolate, opposite, or ternate leave,

8. *Hydrocera.*—The *H. triflora*, is the only known species: it is a native of Bengal, and other parts of India, and known under the name of "Domootee." It is of annual duration, springing up on the margins of ponds as the water subsides in the hot season, growing in considerable depths of water in the rains, and also forming a stout, branching head above it. It has lanceolate leaves, from four to five inches long and near one inch broad; large white flowers, variegated with red and yellow. This species well deserves a place in the garden and is easily cultivated in a gumlah, half filled with

ordinary garden soil. This should be watered sufficiently to convert it into a plastic mud in which the seeds may be inserted in February, or the beginning of March; as they will scarcely germinate until the weather begins to get hot. Water may be added as the plants acquire strength; two or three inches above the surface of the soil is quite sufficient to keep this plant in vigorous health, and it may be thus had flowering on continuously to the commencement of the cold season, when it begins to die down. If the gumlah is undisturbed, and the soil merely kept moist, seedlings from self-sown seed will appear in abundance in the following hot season.

Notes on Horticulture in Bengal, (No. 2)—By JOHN SCOTT, ESQ., *Curator, Royal Botanic Garden, Calcutta.*

No. II.—LORANTHACEÆ, THE MISTLETO ORDER, THEIR GERMINATION AND MODE OF ATTACHMENT.

1. *Viscum.*—An extensive genus, of which there are two well marked groups, namely those with true leaves, which are found in Europe, Southern Asia, and South Africa; and those in which the leaves are absent or reduced to mere scales: a series found in the Indian Archipelago, in the Mauritius, Bourbon, and Australia. All are parasitical shrubs, the branches terete, tetragonal, or compressed; the leaves opposite rarely alternate, frequently wanting or reduced to mere scales. The flowers are always unisexual and either monœcious or diœcious: they have a 4-parted perianth, and either deciduous or persistent lobes; in the male flowers the anthers adhere to the latter and discharge the pollen by a number of pores: in the females the ovary adheres to the perianth, is 1-celled, containing 1 or 3 ovules and surmounted by a sessile stigma. The fruit is a smooth, juicy, and viscid berry, containing a solitary heart-shaped, compressed seed, which has not unfrequently a double-embryo. *V. Album* is the common mistleto of Europe,

and found also in the Western Himalayas, whence seeds have been sent on a few occasions to the Botanic Garden here: none have germinated even when tried in the cold season, nor is it likely that a species, every where affecting as it does, cold and temperate climates, will succeed in the plains of India. Dr. Stewart in his "Punjab Plants" states, that it "occurs in many places at from 3,500 to 9,000 feet in the Punjab Himalaya, and in the Suliman Range. I have noted it frequently on the apricot, peach, and walnut, repeatedly on the pear, Lombardy poplar, Olea and Ulmus campestris, and at least, once on each of Pavia, Alnus, Quercus, Morus serratus, and Cratægus crenulata." Griffith found it on the Quercus Ilex in Afghanistan, at an elevation of from 3,600 to 4,000 feet, and states that it is there used for fodder. It is an evergreen, parasitical shrub, of which that part corresponding to the root in ordinary plants becomes imbedded in the wood of the tree on which it grows. The terete and swollen jointed stem is much sub-divided, in a regularly forking manner; the leaves are opposite, sessile of an oblong or somewhat lanceolate shape, a firm leathery texture, and of a greenish-yellow colour. The flowers are yellowish, the males in clusters of about 5 in the fork of the branches, as are also the frequently solitary or ternary female flowers. The fruit is a white pellucid berry, containing a single seed, surrounded by a glutinous pulp, which is often used for bird-lime. In the economy of the plant this viscous matter serves an important end, in causing the seeds to adhere to the bills of birds (on which the plant is largely dependant for its distribution, indeed its existence as any single tree or branch must sooner or later succumb under the fosterage of a colony of mistletos, and thus seal their own fate with that of their foster-parent) and are thus transferred to other trees, on which they are similarly fixed, until the processes of germination effect new and more permanent attachments..........The mythological legends associated with the mistleto are very numerous; it was even worshipped by the ancient Britons and served many important rites to the

Druids, who were wont to send round with branches of mistleto to announce the coming in of the New Year: a custom yet kept up in France, and of which we have also traces in its use amongst our *Christmas decorations*. *V. monoicum*, of Roxburgh, is a species found in Eastern Bengal and Orissa. It is a shrubby, evergreen parasite, with terete, jointed, and repeatedly forked branches; opposite, oblong lanceolate, leathery leaves, about two inches long by one inch in breadth. The flowers are sessile in the forks of the branches, in clusters of about 3, of which the central one is male and the 2 lateral female. It is generally believed that as the mistletos have an independent eliminating power, these qualities, will be but slightly, if at all, modified by, or partake of, the qualities of their foster-parent. As opposed to this view I may here give the following quotation from Balfour's Cyclopædia of India, under Viscum monoicum, which has been supposed to be the plant referred to. "In 1837, Lieutenant Kittoe, then with his regiment at Cuttack, received information of the existence of a parasite on the Nux Vomica trees, to which extraordinary medicinal powers were attributed by the natives. They called it Kuchila-ke-mulung, held it to be an extremely powerful narcotic, and poisonous in small doses, and they used it in the treatment of agues and rheumatism. Lieutenant Kittoe having procured specimens of the leaves, sent them to Dr. O'Shaughnessy, for experiment. Given in three grain doses to dogs and kids, tetanic spasms set in, in the course of from five minutes to a quarter of an hour, recurring at intervals, and proving fatal by fixing the diaphragm, and causing asphyxia." These results, remarkable though they undoubtedly are, have not been quoted in any of the Class-books of Botany or Floræ Medicæ, which I have seen, and probably require confirmation, in case of any mistake in the kind of leaves actually submitted for examination. From the above statement, Lieutenant Kittoe had never seen the plant growing, but had only heard from the natives of the

existence of such a parasite, and been furnished with leaves only (not improbably in a dry state) to determine the character of the plant. It must also be remembered, that the natives do not usually distinguish parasites from epiphytes, so that considering the innocuous qualities of all the known plants of the order, there is a pardonable suspicion of the plant in question having other than an analogical relationship to mistletos. I have looked in vain on all the trees of Nux Vomica, which I have seen for Loranthi, but have never found them fostering one, even though surrounded by other kinds, truly overburdened.

2. *Loranthus.*—An extensive genus, found in nearly all tropical and sub-tropical regions. They are dichotomously branching shrubs, parasitic on other shrubs or trees, the leaves opposite or alternate, entire, and usually thick and coriaceous. The flowers are in spikes, corymbs or panicles, usually bisexual; the calyx has an ovate, or rarely turbinate tube, with a short truncated or toothed limb; 4 to 8 petals, either free or more or less united; the stamens equal in number to the petals and opposite to them; the ovary 1-celled, containing one pendulous ovule, and crowned with a filiform style, and a simple, capitate or turbinate stigma. The fruit is an ovate or top-shaped 1-seeded berry, usually crowned with the limb of the calyx. *L. buddleoides* is found in the forests at the base of Parasnath, and not unfrequent in various parts of South India: it is the L. Scurrula of Roxburgh. It is a somewhat compact habited parasitic shrub, with opposite, cordately-ovate leaves of a thinnish texture, and when young, covered with a greyish puberulous matter, (more especially on the under one-side) soon disappearing from the upper. The flowers are small, of a rusty grey colour, and covered with a mealy tomentum; the berry is top-shaped and 1-seeded. *L. longiflorus* is a commonly distributed Indian species: it is the L. bicolor of Roxburgh, the Bura Mudha, or Agache of the natives of Bengal. This is an

exceedingly handsome parasitic shrub, of large and rapid growth : it has stout, ramose, greyish-barked branches, opposite or alternate, smooth and leathery leaves, varying in shape from narrow-lanceolate to oblong-lanceolate or broadly ovate and obtuse, and from 3 to 7 inches long by 2 to 5 broad : they are of a dull green colour, with the midribs, veins, and margin, more or less distinctly, and often prettily tinged with carmine-red. The flowers are large and pretty, borne on many-flowered axillary and lateral racemes : they have a curving slightly inflated tubular corolla of a reddish-orange colour, with an oblique greenish-coloured mouth, and a limb of linear reflexed segments of a pale lemony-green colour : stamens 5, the anthers linear and projecting from the corolla mouth, on pale carmine filaments : the fruit is oblong, smooth, and pulpy, crowned with the limb of the calyx, and containing one seed.

The nature of the attachment of the Loranthi to the plants on which they grow is of great interest, and has been studied and described by several excellent observers ; though from the many essential points on which these authorities differ, it must be admitted that the physiological relations of parasite and prey are not as yet satisfactorily determined. Though I have myself made the subject a special study (on at least several of the Indian species) in the absence of sectional drawings, which I cannot introduce to this Journal, I can but treat the subject in a very superficial manner, thus confining myself largely to general structure, the mode of attachment, and the germination of the seed. First for the seed and its germination, taking by way of illustration that of *L. longiflorus.* The seeds of this species ripen in the hot season and are then surrounded by a strongly viscous pulp which readily fixes them to any branch or substance to which they may be applied. The viscous matter soon acquires a firmish consistency, and forms a protecting layer to the seed : germination will generally have commenced in ten or twelve days, and the first apparent process is a curving extension of the radicle towards

the supporting surface, which a month or so later, it will have reached. The apex of this process then expands more or less in an oblong manner and forms a firm, discoid attachment on the surface of the bark for the nascent plant. This seems to be a critical period, and, though the seedlings may thus retain their vitality for an year (or even more, as I have seen them) many do ultimately die; apparently, from the inability of the root-processes to penetrate the dry, dead; and hardened bark of some of our trees; while others, as many Sterculias, Dillenias and Nauclea, &c., in which the bark is thrown off periodically in large plates, afford an unfavourable *nidus* (in casting off the seeds ere they have penetrated the inner layers) and are thus rarely fosterers of Loranthi. The bark of Melaleucas and other allied genera of myrtles, composed as it is in many species of innumerable dry membranous layers impermeable to the young radicle of the Loranthi, is thus most unfavourable to their development, and, indeed, I have never found a single species on one of them. Under favourable conditions, (as on a thin, soft, and juicy, and more or less split bark), the root-processes are by no means slow to invade the cambium layer, and then excite the development of the plumule or first bud of the seed; and I shall presently explain how this is effected. Preliminary to this, I may remark, that if at the above stage, we make a section of the young plant and its stock so as to show their mode of attachment, we find that a slender cellular tongue-like mass interspersed with a few club-shaped processes has penetrated to the cambium layer and expanded in a disc-like form on the surface of the young wood. The developmental history of these organs is as follows. After the epi-cortical discoid process has been formed, we find, on examination, the primary flat interior surface quite concave and filled with a strong viscous elastic secretion, of a pale-yellowish colour, which dries quickly on exposure to the atmosphere. On the extending rhizome, these organs originate irregularly at points imping-

ing upon the bark, and always a few lines below the apex, which, though closely applied to the bark, is then free and destitute of any adhesive secretions. The first indication of the production of the discs, is a slight swelling of the bark in the axial line, which quickly bursts and exposes a viscous granular mass of cells, very similar to the first intrusion of the rootlets in the creeping Fici: *F. stipulata* for example. Thus cemented to the bark, it now expands by a vertical and centrifugal cell development into the characteristic disc or pad ; the inner surface being covered, as stated above, with an adhesive and elastic substance. In a line with the axis of the seedling plant, or the rhizome, as the case may be, (the subsequent development of both being the same); a tongue-like process gradually protrudes. For many months after this little apparent change takes place, further than the gradual softening of the opposed bark of the supporting plant, by the diffusion of the viscous secretions of the parasite. These primary stages of the development of the root attachments I have generally found to extend over from ten to twelve months, or from one rainy season to another. The recurring vegetative stimulus simultaneously influences both, a tongue-like process grows dowhwards from the axis of the parasite (be it that of the seedling plant or the rhizome) to the bark on which the diffusion of the parasitic secretions has induced a reaction, somewhat analogous to that preceding the genesis of adventitious buds. [I have not indeed tried the experiment, but I suspect, that, if at this stage the root-processes were detached, the plant would produce a lateral bud from the effected part. A Loranthus-bearing branch of Salix tetraspermea, now before me, confirms this opinion thus far, that, on a spot on which no bud previously existed, one has been developed from a part thus affected by a sickly young Loranthus.] A slight thickening of the inner layers of the bark immediately opposite the discoid attachment being observable, and this increasing upwards in a conical manner, thins out or even ruptures the outer layers of bark ; thus favouring

the intrusion of the root-processes of the parasite, and the completion of its conditions of existence. The development of the parasite now goes on with rapidity, new stems spring up from the upper surface of the extending rhizomes, and from below, series of disc-like processes are being developed, to again form the parasitic attachments described above. A similar relation of parasite and prey is ever afterwards sustained, and in none of the many sections which I have made of the attachments of *Loranthus buddleoides*, *L. longiflorus* and *Elytranthe globosus*, have I found them penetrating the woody tissue beyond their original *lieu de repos*. A simultaneous growth is afterwards maintained between the parasite and prey, and the consequent result is the imbedding of the lower parts of the former, in the subsequently-formed woody layers of the latter. The cambium tissue of both being thus on the same plane and in close contact, it is important to observe, that they never, as I believe, effect with each other, anything approaching a permanent organic union; and thus as it appears to me parasitism in the Loranthus and their allies, as probably throughout the vegetable kingdom, is essentially dependent on the immediate contact of the cellular regions of parasite and prey. I am aware that the physiological relations of parasitic Loranthi have been regarded as analogous to the scion and stock in grafting: this is a mistake, they are essentially distinct, the relations of the parasite and the prey being strictly analogous to the latter, and the soil in which it grows. The individuality—organically and physically—being equally as complete; and thus we find the stems of the Loranthi forming snags in the branches in which they have been imbedded: a somewhat remarkable result when we reflect on the interconnexion of their respective cambium regions. This view is, I am aware, opposed to the observations of Unger and others, who consider the inosculation of the vascular tissues of the parasite and its prey an essential condition of all cases of parasitism. I quote from

Dr. Harley, in his elaborate paper on the "Parasitism of the Mistleto" (see Transactions of the Linnæan Society, Vol. XXIV., page 183.) "In fig. 17, tab. III., he has represented the scalariform ducts of the extremity of the root-substance of Viscum regularly opposed to, and directly inosculating with, the dotted vessels of Cratægus, and opposed to none other of its tissues." A similar view appears to have been adopted by Adolphe Pitra, in the Botanical Zeitung for 1861, and in the figure he represents the fibro-vascular bundles of the foster-plant curving towards the sides of the roots against which their extremities abut at various angles. Dr. Harley, on the other hand, considers, that the phenomena in question are produced by the absorption of the fibro-vascular bundles about the angles of convergence or of divergence, in the extension of the root in these directions, and, therefore, to be independent of any tendency to inosculation of the ducts. Though Dr. Harley thus opposes the inosculation of the vascular tissues of the parasite and its foster parent, he, on the other hand, considers that a confluence does take place in the cellular system, and that, indeed, this is an essential condition of the parasitism of the mistleto. Thus in his remarks on the cortical systems of the two plants, he says that "the growth of the mistleto causes great thickening of the bark in its vicinity, and its older layers are pushed outwards and cracked by the distending base of the parasite, and thus a superficial appearance of necrosis is produced; but on closer examination, it is found, that the younger layers of the bark are in intimate living contact with the corresponding layers of the bark of Viscum. The contiguous margins of the barks are mutually levelled; that of the mistleto at the expense of its outer surface, that of the nourishing plant at the expense of its inner surface; and the bark of the parasite is received within, and thus shortly invaginated by the bark of the nourishing plant, at the surface, and for some little distance inwards, the barks are often separated by a little chink; there

is, in fact, no union between the dead outer layers of the barks; but more internally they form a continuous living stratum, covering over the smooth line of junction between the wood of the two plants, and thus the uninterrupted circulation of the sap through both is secured." Again, he states, that "the young roots of the mistleto, and the bark of the nourishing plant live contiguously in organic union with each other." My observations on the relations of the cellular systems of the two plants differ from Dr. Harley's; though it may be as well to state, that Dr. Harley's have reference to the Viscum album, whereas mine have been made on *Loranthus buddleoides*, *L. longiflorus* and *Elytranthe globosus*. I have particularly examined these relations under lenses of 150 to 300 diameters, in both milky and limped juiced plants, as also in that of the gamboge-coloured Xanthochymus; and I am convinced that the two cellular systems rarely, if ever, form true inosculations: the two tissues, though closely applied to each other, seem to me to preserve their individuality, and are in most cases separable without mutilation of the parts, which could of course not be effected in a living and organically united tissue. The two systems are necessarily closely applied to each other, and the line of contact is frequently uneven, though always distinct, and as clearly separable as in the most perfect articulations. The greater density of the cell contents of the Loranthi, relatively to those from which they derive their nourishment, must also be highly favourable to endosmotic communication and sustain a regular circulation of the sap.

We will now proceed to explain the development of the rhizomatic and root processes of the Loranthi and their relations to the foster-plant. When the young plant has attained a height of from one to four inches, it throws out one or more rhizomatic processes from near the base of the young system. These extend often to a considerable length along the surface of the supporting branch, and attach themselves to the bark

of the latter by a series of sucker-like processes, exactly similar to that attaching the seedling plant. These suckers, or *haustoriums* as they are technically called, are frequently produced at very regular distances, and either in close juxtaposition, or at distances of from half to two or more inches. They are of a more or less oblong shape, increasing both in height and thickness according to the greater or less vigour of the plant: generally from a quarter to half an inch in the larger diameter, though I have specimens of them an inch and-a-half in diameter and of a globular shape. As in the case of the original seminal sucker, those of a secondary origin also give off root-processes which penetrate the bark and cambium layer and abut against, without in any case, as I have previously remarked, actually penetrating the woody system. A more or less simultaneous growth of the parasite and prey now goes on, and the following are the general results. In cases where the foster-plant is of quick and vigorous growth, the chances are that the rhizome and its suckers will be wholly enveloped in the branch to which it is attached, while in the meantime lateral shoots are developed more or less regularly along the sides or upper surface of the rhizome, and in their turn give origin to other rhizomes. Thus struggles the parasite and prey, until one or the other, usually the latter, is destroyed and accordingly seals the fate of both. Again, in cases where the growth of both is equalised, the original rhizome may, for years, retain its epi-cortical relations by the lengthening of the suckers, in the same ratio as the supporting branch increases in thickness; the lower parts of the former being thus alone imbedded in the woody system of the latter, affording in old branches most interesting and (as it has often proved to me before I had specially studied the development of the phenomena) puzzling sections. There are various other degrees of development of the two which I need not refer to here, as those which I have already described sufficiently elucidate the phenomena; in in-

dicating the different results according to the more or less equable balancement of the vegetative forces in parasite and prey. The structure of the rhizomes differs in no essential way from that of the stem, but it is interesting to observe in those cases where two rhizomes come in contact, that while they also become fixed to each other by the usual sucker-like processes, they ultimately effect as complete an union between their woody systems, as in any natural graft. By the way, this, in my opinion, is strongly confirmative of the view I have taken of the physiological relations of the Loranthi to their foster-parents, in showing how the former *inter se* become organically united; rendering it the less probable that such an union in the phenomena of parasitism should at any time exist in their respective cellular systems; and not also be effected and sustained by the vascular system: it appears to me a mistaken notion. I may also mention, that I have observed in the Botanic Gardens here an example of bigeneric grafting between the Loranthi. This is on a specimen of Bassia butyracea, on which the rhizomes of Loranthus longiflorus and Elytranthe globosus have formed a very complete union.

With regard to the development of the woody tissue of Loranthi in the corresponding parts of the foster-parents, the view I have above taken, seems to be that also of Griffith, Unger, and Schacht. Thus Griffith states, "that the fibres of the parasite never penetrate beyond their original attachment, *although the latter developed fibres appear to have the power of arriving at this point, but no further.*" From this and the following question, it is evident that Griffith had then but imperfectly understood the phenomena. The more vigorous and older of these suckers, continues this author "pierce the sap-wood to a greater or less distance; but no identification of substance appears to take place, the fibres of the suckers being at right angles with those of the sap-wood. In all probability they have not the power of piercing into the substance of the wood, their greater depth in

the older and larger branches being owing to the deposit of new ligneous matter. At the same time a corresponding increase takes place in the sucker, which becomes hard toward its base." Transactions of the Linnæan Society, Vol. XVIII., p. 81. Singularly opposed to the above view is that adopted by Dr. Harley, in which he holds that the roots of the mistleto not only penetrate the different layers of bark, but also invade the woody system by way of the lines of the medullary rays. Thus, premising that the mistleto (Viscum album) attaches itself to the nourishing plant by roots, some of which are horizontal and confined to the bark, the others are contained within the wood; Dr. Harley explains that the former or horizontal ramifications, "pervade the bark of the nourishing plant freely, which they can of course only do by effecting its absorption simultaneously with their advance, some pass transversely and partially encircle the branch, but by far the greater number running parallel to each other and to the branch, traverse it lengthwise. Whatever direction they take, they produce at frequent and pretty regular intervals other tapering cellular roots, which, guided doubtless, by the medullary rays of the bark, pass towards the surface of the wood, and are thus brought into contact with the ends of its medullary rays. They are subsequently found imbedded at various depths in the hard wood of the nourishing plant, like the primary roots. . . . . The horizontal roots are cylindrical, and are wholly contained in the bark, and such being the case, they are each year removed further outwards from the surface of the wood of the nourishing plant by the indigenous growth of its bark; and when the more external layers in which they lie become cracked and dead and fall away, they are discovered. Meantime, these roots increase in size and harden in texture by the formation of woody layers." Such then are Dr. Harley's views as to the development of the rhizomatic processes of the mistleto in the branches of its foster-parent, and for which I will now briefly assign reasons for

regarding them as untenable: the structural development being evidently misinterpreted. First as to the rhizomatic processes of the mistleto (Viscum album,) which, unlike those of the Indian Loranthi examined by me, are imbedded in the bark, parallel with, and in immediate proximity to, the cambium region, and in this respect differing very immaterially from the normally epi-cortical rhizomes of our Indian Loranthi. Dr. Harley is also careful to impress upon the reader the extra-cambial position of the rhizome, though he neglects to explain how such a position can be sustained, consistently with its fixed attachments in the thickening woody system of the supporting branch. Clearly if the roots of the parasite have a mode of growth similar to those of our mangroves, &c., and thus, from a fixed point elevate the rhizome simultaneously with the development of the branch, it is unimportant whether it lie in the cortical or cambial regions, the results must be the same; and so long as the balance of growth is retained, the rhizome will lie beyond the woody tissue of the branch. Taking these self-evident results then—a simultaneous centrifugal and centripetal development of the root-processes—we are naturally led to enquire as to the period when this nicely-regulated polar growth commenced. Dr. Harley, I dare say, will not, or anyhow does not, pretend to enlighten us on this point; though it is evident, that such modes of development are necessary to the support of the rhizome, they are anything but such to his theory. On the other hand, I am convinced from observations on the development of the homologous processes in the Loranthi, that the mode of growth, relatively to the supporting branch, is largely and chiefly centrifugal, corresponding closely to that of such gouty stemmed plants as Adenium, &c. Thus, as previously stated, and in accordance with the more or less equally balanced growth of the respective parts of parasite and prey, the *rhizome* of the former may or may not become imbedded in the woody system of the latter, whereas for the lower parts

of the *sucker-like roots*, this is a necessary result of the progress of development, and alike applicable to the *intra* or *epi-cortical* rhizomes of the Loranthi. In the sections given by Dr. Harley, the form and position of the root-processes are very similar to some of those I possess of Loranthus longiflorus and Elytranthe globosus : all are of a more or less oblong shape, the long diameter axial to the branch. It is thus (as shown in Dr. Harley's figures), that the longitudinal sections of the branch bearing mistleto, exhibits linear or somewhat elliptical-shaped root-processes terminating in obtuse and more or less rounded extremities, whereas those exposed in transverse sections are all more or less tapering and sharp pointed according to the angle at which they may have been cut. Dr. Harley, referring to this says, that "the young taper roots also appear wider and shorter in longitudinal sections of the nourishing branch, than in those made in the other direction." These are the appearances, he continues, "which, doubtless, led Mr. Griffith to the conclusion that the mistleto is attached to the stock by sucker-like processes." Presuming that the author has consulted Griffith's excellent paper, I am at a loss to understand how any doubts as to the organs referred to can have possibly suggested themselves. Mr. Griffith not only carefully describes, but specially illustrates, them by whole and sectional figures in Tab. VIII. ; the latter showing that the sucker has pierced the bark and become applied to the wood of the nourishing branch. In regard to their origin and nature, Griffith also states, that " as soon as the parasite has acquired the height of two or three inches, when an additional supply of nourishment is probably required, a lateral shoot is sent out, which is especially towards the apex, of a greenish colour. This at one or two, and subsequently at various points, adheres to the support by means of *sucker-like* productions, which are precisely similar in structure and in mode of attachment to the original seminal one" previously described. . . . . "Again," in the adult plant, he continues " the sucker-bearing

shoots frequently run to a considerable distance, many of the stocks being literally covered with parasites, all of which have originated from one seed. I have seen such shoots, which had taken their course along a decayed branch, become reflexed, and return in quest, as I may express it, of a part capable of affording nourishment. In all the species of Loranthus which I have examined, the same phenomena occur, and also in the species of Viscum from which the drawings were made. I have reason to believe, however, that in some Loranthi and Viscums the attachment takes place by one spot; in other words, that there is only a primary attachment; such will approximate in form to the Viscum album." The latter sentence is, I confess, obscure, and evidently arises from the author's ignorance of the strictly analogous nature of the phenomena in all the plants referred to; which differ only in the one section, having an *intra-cortical*, the other an *epi-cortical* rhizome. I believe that all species of parasitic Loranthi *normally* form many points of attachment with the branches they infect, as is the case in those species under consideration; though even in these, as I shall subsequently show, we find specimens confined to a very limited surface.

Dr. Harley, in a part of his paper subsequent to that above quoted, returns again to the structural developments above discussed, and remarks that "whether the roots of the parasite are implanted in the medullary system of the plant upon which it grows by any invasive action of their own, is not the object of this paper to determine" (I may be mistaken, yet in my opinion it is a question of high importance in any paper professedly treating on the parasitism of the mistleto) "but I cannot pass without specifying the principal anatomical facts which support this view. They are *first* the evidence of repeated absorption of the fibro-vascular bundles, allowing the extension of the roots into the exposed medullary rays; and *second*, the confluence of the extremity of the roots with the central pith, which could only result from an invasive growth of the roots; for,

although a branch may be very early affected with the parasite, we can hardly suppose that this would occur simultaneously with its original development; the branch must be pre-formed, which implies the existence of at least one ring of wood between the point of the root of the parasite and the medullary centre of the nourishing plant." Now, with reference to the first proofs of the invasive action of the roots of the mistleto, I have to remark, that with the exception of the insinuation, and it may be, occasional absorption of cells in the first penetration of the cambium tissue by the nascent root-processes, the subsequent development of these organs being simultaneous with that of the other tissues—be it in the medullary rays or woody layers—there cannot consequently be any evidence, as Dr. Harley would have us believe, of "repeated absorption of the fibro-vascular bundles," nor is any such afforded in his magnified sections on Plate XXX. Related to this is the assumption that the direction and arrangement of the roots of Viscum, which lie within the wood are determined by the arrangement of the medullary system of the nourishing plant, the roots always lying strictly parallel to the medullary rays. In this view the author is supported by Dr. Hermann Schacht who states, that "the root of the mistleto developes on the side of the wood branches which occupy the position intended for the medullary rays of the wood." In the many sections of branches infested with Indian Loranthi, I can find no support for such views; and even as the root processes originate indifferently from any part of the lower surface of the rhizome, so do they indifferently impinge upon the woody layers or medullary rays that may be opposite to them. So far as I recollect this is the case also in branches affected with Viscum album; certainly in many old specimens of mistleto on Apple and Hawthorns, I have seen the roots in both the woody and medullary regions. I am supported in this by Adolphe Pitra, who (as quoted by Dr. Harley) in his remarks on Dr. Schacht's observations, says

that they may be true with regard to certain definite stocks, such as firs and pines, but I cannot establish this fact, as I have not had an opportunity of investigating such stocks; but it certainly does not hold for all. With limes, willows, and other trees, I have found the rule uniformly not established. The place where the sucker (*senker*) meets the wood is quite accidental, and is usually not that of a medullary ray; besides the sucker is from the first much too strong and too broad (in the section of a yearling shoot) for it to correspond to a medullary ray."

Secondly, let us consider the support afforded to Dr. Harley's views by the confluence of the extremity of the roots with the central pith, "which" remarks the author "could only result from the invasive growth of the roots, &c." This seems to me a most unfortunate and untenable assumption, applicable only to species (if such there are?) destitute of the rhizomatic and secondary root-processes. On the other hand, in species such as those under consideration, the rhizomatic processes of the parasite may and do occasionally reach the apex of its supporting branch, (especially on short lateral branches), and thus united apex to apex undergo a simultaneous extension, and have its root-processes directly applied to the medullary sheath. I have actually found such relations in young shoots of Salix tetrasperma, Terminalia Catappa, Ficus religiosa and Jambosa vulgaris, infested with the Loranthus longiflorus, and Elytranthe globosus; and there is no reasons why similar relations may not occur in the parasitism of the Viscum album. The great extension of the rhizome is interesting. I have measured specimens of Elytranthe globosus on Salix tetrasperma, in the Botanic Garden here, with rhizomes of from eight to ten feet long attached firmly to the willow branch by numerous suckers, and giving off many new shoots. On branches of Jambosa vulgaris, I have also measured equally long rhizomes of Loranthus longiflorus attached at more or less equal distances to its supporting

branches by its sucker-like processes, and producing shoots irregularly along the lateral and upper surface.

With regard to the preference of the Loranthi to certain trees, Dr. Harley is of opinion "that, other conditions being equally favourable, the size and number of the medullary rays is the chief cause which determines in any given case the attachment of the mistleto; and this is probably true of all other cases of parasitism. With a view to testing the truth of this supposition," remarks Dr. Harley, "I have examined the wood of those of our indigenous trees and shrubs which from their size, distribution, and aggregation, are liable to the attacks of the parasite, and also that of some of the plants to which it is naturally attached or upon which it may be made to grow." The results are [illegible] in detail; and comprise the measurements of the depth and width of the individual rays, their relative disposition, and the number of cells of which they are composed, in thirty-two kinds of plants. The rays vary in the different kinds from the $\frac{1}{20}$ of an inch in depth, to the $\frac{1}{2500}$ of an inch in width, and do not, by any means, afford much support to the theory that the greater or less liability of plants to parasitic infections is dependent on the size and number of the medullary rays. Thus in some parts of the Continent of Europe, the common Fir, Pinus sylvestris, is much infected with mistleto, though the depth of the ray is one of the smallest recorded in the observations. Dr. Harley regards such, as only apparent exceptions, however, and would thus explain them :—*First*, "the precariousness of the dissemination of Viscum, the only means for effecting the process being extrinsical and accidental. The more closely, therefore, a tree is approximated to a fertile plant, the more certainly will it be affected, and *vice versa*. The greater frequency with which mistleto attacks apple and hawthorn-trees as compared with maple and walnut-trees, which upon the theory are much more liable (as having deeper and wider medullary

rays) is thus accounted for. There is, perhaps, no tree in the series more liable to the attacks of the parasite than the maple, nor one that suffers so much from its ravages. *2ndly.*, the nature of the bark, but especially of its periderm. The immunity of the holly, birch, and alder is, doubtless, due to the condition of this outer portion of their barks, forming as it does in them, dry, smooth, and unbroken surfaces. . . . . The poplar, which, as far as my own observations extend, is more liable than either the lime or ash, appears to be the only exception to the theory; but in this tree there are greater pre-disposing conditions: thus, the nature of the bark is most favourable for the attachment and germination of the seed, and the wood is very soft, and, from the number, size, and arrangement of the ducts, is easily separable in the direction of the medullary rays. The mistleto is but rarely found on elms and oaks, and never, I believe, on the horse chesnut; yet these trees, except as regards their medullary system, appear, in all other respects, *viz.*, of number, size, aggregation, and condition of the bark to be even more exposed to the attack of the mistleto than the apple and hawthorn." It is curious, however, that Loranthus Europœus should chiefly, as I hear it does in the South of Europe, affect the oak and sweet chesnut. Again, it has been well remarked by the reviewer of Dr. Harley's paper, in the Nat. Hist. Review for 1864, p. 241, "that medullary rays are apt to be very variable in their vertical extension, though probably they may be tolerably constant in width. Dr. Harley ought to have stated in giving the dimensions of the medullary rays of the common oak, that the small rays only are referred to. This places the oak, upon which the mistleto is rare, very low down in his table, so as to suit his hypothesis very well. But it must not be forgotten, that the Oak, like the Beech (with which it is bracketed), and unlike the Chesnut (with which it is also bracketed) possess two kinds of rays, large and small."

With reference to this theory, I can but repeat that

in all my observations on Loranthi, the relations between the medullary rays and the secondary roots in any infected branch are decidedly casual; and the parallelism that may exist between them is but a natural result of the mode of development of their rhizomes. It is, however, affirmed by Dr. Harley, that in branches with an excentrical pith, the parallelism is also retained, and the points of the root-processes still directed to the pith. This may, or may not, happen: thus roots simultaneously developed in an excentric branch will, as a matter of course, retain the parallelism, while on the other hand, the chances are few, of any such coincidents occurring when the eccentricity has been acquired prior to the attachment of the mistleto: passing off more or less closely at a right angle from the rhizome they will and do variously intersect the medullary rays. This I find to hold alike in species with intra-cortical and epi-cortical rhizomes; both generally extend in nearly straight lines and parallel to the axis of the branch to which they are attached. Whereas in consonance with the existence of any degree of elective affinity between the root-processes of the mistleto with the medullary rays of its supporting branch, those species with imbedded rhizomes should (in accordance with that electivity, and the prevalent spiral mode of development of plants) extend along the stem in a more or less distinctly spiral manner. Thus, as it appears to me, the theory that "other conditions being equally favourable, the size and number of the medullary rays is the chief cause which determine in any given case the attachment of the mistleto" is untenable.

On the other hand I believe that the habit and chemical qualities of the bark of plants chiefly determine their relations to the Loranthi, as indicated by the following observations. First, *habit:* trees of compact habit and heavy evergreen foliage; as some of our Magnolias, Guatteria, Garcinia, Nephelium, Jambosa, Diospyros, Artocarpi, Putranjiva, &c., are all unsuited to the Loranthi, and apparently for no other

reason than the above. It is curious to observe how strictly the Loranthi when seen on healthy specimens of any of the heavier foliaged species of the above genera, are confined to the extremities of the shoots. There they live and flourish, only so long as they can extend a-pace with the lengthening shoots: failing this, as they become enveloped in the dense foliage, their vigour fails them, and sooner or later, they die out. *Secondly*, heavy-foliaged deciduous trees are also generally unfavourable, partly owing to the dry, scaly nature of the bark, the loss of foliage in the cold and hot season, and the heavy shade afforded throughout the rains. It is thus as I believe that we rarely find Loranthi on several of the species of the following genera: Dillenia, Flacourtia, Salmalia, Sterculia, Schleichera, Melicocca, Spondias, Erythrina, Terminalia, Nauclea, &c. Again, dry and thick-barked species as Eucalypti and Melaleuca of various sorts, Adansonia, Xanthoxylon, Ailanthus, Poupartia, Boswellia, Balsamodendron, various Araliaceæ, &c., are all unfavourable; and though I have frequently found seedlings on some of them, I have rarely found them supporting old plants: the seedlings generally dying ere their roots can penetrate and draw support from the inner layers of bark. I find also that trees whose bark has acrid, bitter or astringent qualities, whether limpid or milky juiced, are but little liable to the attacks of Loranthi, and the less so as these qualities become the more pronounced. Thus; on Melia azadirachta with a nauseous and bitter bark, we never find a Loranthus; whereas on that of the blander Melia composita and sempervirens, they are by no means uncommon. On the specimens of the following genera, growing in the Botanic Gardens here, I have never seen a single plant of Loranthus establish itself; though, all are more or less in proximity to other trees bearing them. These are Ochna, Brucea, Simaruba, Averrhoa, Rhamnus, Cæsalpinia, Hæmatoxylon, Acacia Catechu and A. Arabica, Lebidibia, Hymenodictyon, Ilex Paraguayen-

sis, all of our Apocynaceæ (with the exception of Nerium) Loganiaceæ and Emblica, &c. The rare occurrence of the mistleto on the oak, is probably largely due to the astringent qualities in the bark of the latter, and partly as in the case of Elms, Chesnuts, and others, from the heavy foliage which shrouds them in the growing season, and drops to expose their unripened shoots to a winter's vigour. Again, those with a resinous juice, as the Dipterocarpi generally, the Canariums, many of the Guttiferæ, Melanorrhæa usitatissima, Piscidia, Schinus molle, Semecarpus, Styrax and others, are not at all liable to the attacks of the parasitic Loranthi, and indeed I have never found specimens on any of them, in the Botanic Gardens here. On the other hand, light airy foliaged trees, with a bland, limpid, or milky juice, and a soft, thinnish, coarse-textured bark, are all especially liable to become the prey of the Loranthi. The following list is confined to the different kinds of trees more or less infected with Loranthus longiflorus in the Botanic Gardens here:

Salmalia malabarica	Gleditschia sinensis
Sterculia villosa	Pyrus sinensis
Ægle marmelos	Terminalia Catappa
Citrus decumana	,, angustifolia
Xanthochymus ovalifolius	Jambosa vulgaris
Banisteria laurifolia	,, polypetala
Cupania canescens	Lagerstræmia reginæ
Melia composita	Bassia butyracea
,, sempervirens	Mimusops elengi
Chloroxylon swietenia	,, imbricaria
Zizyphus jujuba	Tectona grandis
Mangifera indica	Ulmus virgatus
Garuga pinnata	Ficus nitida
Inga dulcis	,, religiosa
,, hæmatoxylon	,, glomerata
Dalbergia sissoo	Antidesma bunias

In the above list, there are a few umbrageous evergreen

trees included such as Bassia butyracea (an old thinly-branched tree now becoming quite over-run with the parasite, though on the younger and more vigorous specimens, few have succeeded in establishing themselves, and these only at the extremities of the branches) so also in the cases of Mangifera Indica, Jambosa vulgaris, and Mimusops Imbricaria. On these trees, as I have above remarked, the parasite strives to extend with or beyond the branches, frequently with a surpassing vigour, so that the extremity of the branch is atrophied and the parasitic rhizome dies back to a vigorous stem causing a more or less extensive hypertrophy of the woody layers are subsequently formed around its base. The plants thus frequently form a large and bushy head, and though many parasitic suckers shoot out around the base, we rarely find them producing epi-cortical rhizomes. The branches of teak-trees when attacked by Loranthus, generally become much hypertrophied, but fortunately it seems to be one of those heavy foliaged deciduous trees, on which these parasites are driven to the extremities of the branches, and are thus not likely to do much damage to the trunk or heavier branches. The L. longiflorus however, when thus fairly established about the extremity of a stout branch, grows with great vigour, producing a large irregular swelling around its base, whence proceed strong and numerous shoots, with leaves of a thick leathery texture and often as much as 7 to 9 inches in length by 6 to 9 in breadth: certainly the largest sized leaves I have ever seen it produce. On trees of this habit, the seedling parasite, though it always bears the characteristic rhizome in the younger stages, is generally destitute of it in the older or full grown plants: all either dying back to the base of a stout stem or becoming imbedded in the hypertrophied branch. It is also interesting to observe, that while on light, airy foliaged trees, the rhizomes extending towards the base of the branch are generally much stouter and more vigorous than those extending towards the apex; whereas under the

above conditions, the reverse is the rule, and we find the inwardly directed rhizome weak in the extreme, and soon becoming imbedded in the thickening branch; the apically-directed shoot absorbing all the vigour. I have specially examined this on Teak and Jambosa vulgaris. It naturally occurred to me, when I first observed the Loranthus longiflorus and Elytranthe globosus, thus confined to a single attachment and apparently destitute of the epi-cortical rhizomes, that the latter, as in the case of the common mistleto, might possibly be found extending along the inner layer of bark. This was a mistake: specimens now before me of both the above named parasites, present no such phenomena. I shall describe a few of these, first from one of Jambosa vulgaris. The foster branch is only *three-fourths of an inch* in diameter immediately below the attachment of the parasite—L. longiflorus—and apparently in the early stages of the development of the latter, the extremity of the branch has been utterly atrophied, as no trace of it now remains. The parasite is thus attached to a hypertrophied apex, a longitudinal section of which exposes a ball-and-socket disposition of the parasite and prey: the latter forming a very regular cup-like dilatation, *three inches* in diameter by about the same in depth, and containing the somewhat conical extremity of the parasite, the base of which is only *three lines* below the plane of the last woody layer of the branch: a highly important physiological fact, as I shall now explain. The branch with its hypertropied apex strongly resembles a large tobacco pipe, the former corresponding to the stalk, and the swollen apex to the bowl, the latter being quite as sharply defined and rising up at about the same angle from the branches, as in an ordinary meerschaum pipe. I will repeat the measurement: branch at the angle whence it springs up into the cup-like dilatation, *three-fourths of an inch* across, while the diameter of the latter is *three inches*. Now, the base of the parasite rests on the *third* woody layer of the branch and is imbedded in *two* more, when

the atrophy of the upper portion of the branch, as one may suppose, had been completed. During this period, also, the irregular woody layers forming the base of the cup have been developed, and measure three to six lines in thickness with a regular, unhypertrophied bark, two lines thick. The woody layers of the branch thus indicate it to be of five years growth, and as I have above shown, it was three years old ere the parasite became attached to it. The parasite, on the other hand, as indicated by the woody layers of the stem, is of eight years' growth, and at the neck is an inch and-a-quarter across, terminating downwards in an irregularly conical base: the woody tissue of the nourishing branch being separated from that of the parasite by an amorphous fibro-cellular, fungoid growth, which varies from three to six lines in thickness, and strongly resembles the corresponding parts of such root-parasites as Balanophoras. The cells are usually rich in minutely granular starch, while the intercellular spaces are filled with gummy secretions, and in sections form large angular granules. The development of the nourishing branch would thus appear to have been utterly arrested (as I can see no traces of subsequent deposits) for a period of six years, forming a mere vehicle for the supply of crude sap to the parasite. It was thus functionally analogous to the woody adventitious roots of the arborescent monocotyledons, and similarly destitute of medial foci of development. It is important also to observe, that the cambium tissues and bark differed in no respect from those on active, or organising portions of the stem. Again, the branch supporting the parasite was fourteen inches long, and a secondary shoot from a stout branch of which those later developed, and unburdened with parasites were many times stouter. Throughout the whole length of the parasite-bearing shoot, the diameter was nearly uniform, with a slight thickening towards the base, where it may be supposed to have received a modicum of elaborated sap from the branch, from which it springs. I have already pointed out important structural and

physiological differences between the phenomena of parasitism and grafting; but I know of none more important than that which I have now illustrated. Practical physiologists are familiar with a class of facts, illustrative of an inherent developing power, which plants may possess, in the absence of leaves. Dutrochet was the first to notice this in roots of the Fir-tree, some of which in the Jura, he found alive and growing forty-five years after the trunks were felled. Gœppert noticed it also in the case of Abies pectinata and excelsa, though he ascribes it to their having become naturally grafted to the roots of contiguous trees. There are many other examples, however, of tuberous-rooted plants increasing in size and living for many years, without leaves or attachments of any kind to other plants: the processes of assimilation, &c., being carried on by the green and exposed bark. In the above case of Loranthus, however, we find that development is entirely arrested. This may be simply a result of the sap-supply being sufficient only for the demands of the parasite, though I am rather disposed to ascribe it to the more or less complete arrestment of endosmotic action (from the viscous juiced cells of the Loranthus, to those of Jambosa, with a thin, limpid juice) and the incompleteness of the assimilation and respiratory processes of the intermediate bark. I am aware from experiments published in the *Comptes Rendus* (August 16, 1852,) that the stems of mistleto-bearing specimens of Acacias, Apple-trees, Poplars, &c., increased in diameter after they had been stripped of their own leaves and branches; but this was more probably due to the completeness of the assimilative and respirative processes of the large surface of bark, acting on the crude ascending sap, then to any elaborated descending current from the mistleto.

The next specimen which I have to describe is of a Teak branch bearing a large plant of Loranthus. The parasitic portion is twenty inches long and bears two large and distinct plants, and one small. The largest specimen has an irregular

oblong base, ten inches long, by from two to four inches deep, and gives rise to two stout stems, respectively one and two inches in diameter, the larger of eight, the smaller of four years' growth. The second plant has a base four inches in length by from two to three inches in depth, and gives rise to two stems, each about an inch and-a-half thick, and in section exposing six woody layers. Each of the above specimens rest in a well-defined cavity of the branch, and as in the case of that above described on Jambosa vulgaris, give off no rhizomatic or root-processes either in or above the bark. Both are also attached to the same side of the nourishing branch, and it is interesting, as bearing, on the absence of any active communication in the descending sap from the parasite to its fosterer, to observe the small size of the annual woody layers of the latter in a line with the former, as compared with those on the opposite and free side of the branch: the measurements of the ten layers on the latter being nearly two inches, whereas on the former side, they were comprised within a quarter of an inch. The bases of both the above specimens were much decayed for some distance from the centre as were also the adjoining portion of the fostering branch, the living and vegetative attachments, being chiefly confined to the inner cortical and upper woody layers. I have examined several other specimens, but as none of them differed in any important respects from those already described, it would be superfluous to describe them here. All agree in having no rhizomatic processes in the adult state, and in being attached on a more or less extended, though continued surface to the supporting branch, and in this respect presenting a curious modification of the normal mode. The relation of these parasitic plants to their foster-parents are thus strictly analogous to those of rhizome bearing plants to the soil. In these we find species with rhizomes growing on the surface of the soil, or *epigæous*, while others penetrate the soil to different depths, thence extending in a more or less horizontal direction, and then

termed *hypogæous*; or again we may have as in some few adaptive modifications of these, and an *epigæous* or *hypogæous* plant will produce a *tufted* or more or less *erect rhizome.* So in the parasitic genera Loranthus and Viscum, we find the rhizome in certain species extending along the surface of the bark *(epi-cortical)* and attaching itself by a series of suckers which invade the latter to its innermost layer in search of nutritious juices; while in the others, the rhizome is *intra-cortical*, or extending itself within the layers of bark, and giving out like the above, root-processes, which also penetrate and imbibe the juices of the inner layers: their powers of elimination enabling them to draw, as I believe, indifferently upon both the crude and elaborated sap, from the many kinds of trees on which they do establish themselves. Again, we have adaptive modifications of the preceding forms on some of our heavy foliaged trees, as also on those with a thick, dry, and papery bark (which the young roots can either with difficulty, and only under most favorable circumstances penetrate), whereby the development of the lateral rhizomes is arrested, and a large tuft springs out radially from a single and more or less expanded attachment.

Two other specimens in my possession are worthy of description from the novelty of the attachment of the parasite to its prey: both are on Nerium odorum. The *first* is attached on the upper surface of the petiole of a leaf, and has a main stem five inches in length, with two lateral ones of about four inches; the basal girth of the main stem being four lines. Several rhizomes have been produced, but one only has extended along the stem, forming firm attachments for the length of nine inches: the others—three—extending along the surfaces of the leaf have failed in effecting a secure attachment, and continued slender and contorted, *giving out in place of the disc-like processes, numerous slender rhizomes in search of fixed attaching surfaces.* The lamina of the leaf, though still attached, was dry and dead, all nourishment having been arrested by the parasite. The foot-stalk had increased much

in thickness: the lateral measurement being five lines, the vertical three lines, whereas in the normal condition, we find them respectively one and-a-half and one line. Again, while a section of the petiole in its ordinary state exposes a minute semi-lunar band of fibro-vascular tissue, we find it supporting the Loranthus with a hard woody band, three lines broad by two in depth. In the *second* specimen, the attachment is on the midrib of the leaf and an inch and a quarter from the base. The Loranthus has a vigorous, though solitary, shoot two and-a-quarter inches high, with two lateral rhizomes; the one extending downwards to the stem, with which however, it has failed to attach itself, owing to the frequent movements of the leaf, though midway it has formed a normal disc-union with the midrib. The other rhizome extending towards the apex of the leaf is unattached, slender, contorted, and ramifying, as in those previously described. In this case, also, the thickness of the petiole and midrib has been considerably increased. The root-processes pass completely through the midrib, causing a slight local hypertrophy of the tissues in the lower side, though strangely enough, none whatever on the adjoining portions of the blade of the leaf, either above or below.

The *L. longifloras*, naturally an evergreen shrub, becomes, as I have observed, quite deciduous when growing on some of the deciduous trees in this garden. Thus specimens on Sterculia villosa, Salmalia Malabarica and Lagerstrœmia reginæ, remain leafless, or nearly so, with their foster-parents from the end of December until the latter burst again into flower and foliage in the hot season. Again, on such trees as Terminalia Catappa, which suddenly cast their leaves in February, and in a few days are again covered with expanding buds, the Loranthi (as in their ordinary evergreen supporters) lose not their foliage, and then present an odd appearance as they hang out in great tufts from the leafless and bud-expanding branches of those lofty trees.

It is an interesting fact that of the several genera comprising the natural order of Loranths, all, with one exception, are parasitic. Nuytsia is the name of this self-sustainer, which has two specific representatives; *viz.*, the *N. floribunda* a native of King George's Sound and South-Western Australia, where (from the profusion of brilliant orange-coloured flowers which it produces, it has been compared by the Colonists to a tree on fire) it is commonly known as the Flame, or Fire-tree. The second species is *N. ligustrina*, likewise an Australian plant, found by A. Cunningham, in the more arid parts of the Blue Mountains, west from Port Jackson. I strongly suspect, however, from the evident affinities of these plants with the Sandal-woods,—Santalaceæ,—in habit, disposition of the leaves, valvate æstivation and unilocular 3-ovuled ovary; that a careful examination, will, as in several genera of the latter order, expose parasitic attachments to the roots of environing plants. We already know this to be the case in Thesium and Comandra, probably also in Leptomeria and Choretrum; and certainly as I shall now explain, in Santalum. In the Botanic Gardens here, having had frequent occasion to transplant specimens of the common Sandal-wood—Santalum album—I was struck with the repeated failures of all the older plants, as indeed those of smaller size also, unless removed with an unproportionally large ball of soil. The cases of root parasitism in the allied genera, Thesium and Comandra naturally occurred to me, and I determined to take an early opportunity of investigating the relations. This I have now done, and as I suspected found, on carefully tracing out the more slender ramifications (no easy matter,) abundant evidence of its parasitic attachments to the roots of the surrounding plants. I have since exemplified it more fully by placing seedling plants of the Sandal-wood and other plants together in the same pot. Under these conditions it has formed attachments to the roots of Saccharum spontaneum, Bambusa auriculata, Arenga saccharifera, Caryota urens, and

C. sobolifera, Cocos nucifera, Phœnix sylvestris, Heptapleurum venulosum, H. umbraculiferum, and Inga dulcis.

I was led more especially to try my experiments with palms from having observed the Sandal-wood trees growing with unusual vigour in the vicinity of Arenga, and on examination, exposed its copious parasitic root relations with that palm, as also with the common "Kash-grass," Saccharum spontaneum. With the Araliaceæ, I had most demonstrative evidence; first in a vigorous old tree of Sandal-wood growing in the vicinity of a large specimen of Heptapleurum umbraculiferum, which I had occasion to cut out. A few months after this, I was surprised to find the tree nearly destitute of leaves and altogether in a most unhealthy state, though for some time after the ivy-wort had been removed, no changes had been observed. This, however, was probably due to the strong vitality of the ivy-wort's roots, which may have remained fresh for weeks after the stems had been cut out. The tree has since made poor and weak growths, though always yielding an abundance of flowers; and now—the fourth year—it seems to be acquiring fresh vigour, probably from having formed new root attachments. The second case was of a young tree, fifteen feet in height, and growing from the midst of a bush of Heptapleurum venulosum. The latter having been cut out, the young Sandal-wood tree, shortly after lost the whole of its foliage and was for fully two years afterwards in a most unhealthy state. These illustrations, conjoined with the results of transplanting the larger and smaller sized specimens of Sandal-wood, and the copious illustrations of actual attachments, afford most complete and unquestionable evidence of the parasitic root relations of the above tree with those of environing plants.

I have now experiments in hand on the germination of the Sandal-wood, but as these are not sufficiently advanced, I must defer for the present the full illustration of these hitherto unobserved parasitic relations. I shall thus confine myself

to a simple description of the mode of attachment as I have observed it in the full grown plants. Thus on roots of the Arenga saccharifera, we find the rootlets of Santalum attached by numerous tubercular processes, varying from one to six lines in diameter. Their mode of attachment is much less complete than that of the Loranthus, as I shall subsequently show. I may here allude to the important distinction, that whereas we frequently find in the Loranthi every attachment individualised by its own stem, and thus forming a permanent organ for the absorption and transmission of the nutritive juices; in Sandal-woods there is but one stem for an infinity of root ramifications, and thus every lateral attachment is thrown into disuse by the advancing rootlets ever effecting new unions and affording more active and copious sources of supply. It is thus, that we generally find all the older attachments broken; and the little parasitic tubercles, loosely hanging on the roots and resembling more the brown membranous and ruptured sacs of some of the Fungi, than any organ truly pertaining to those roots. The mode of attachment is simple: every root-fibre produces a varying number of parasitic tubercles, many of which never do become attached, while those that do, adhere only to the soft, juicy, and cellular parts of the surrounding roots. In Arenga, it is thus largely confined to the extremities of the roots and those of their lateral ramifications. Lying in contact with these, the parasitic tubercules firmly clasp them in the process of development and simultaneously emit a mass of cellular papillæ which penetrate the cortical parenchyma and intermingle with their cellular interior. In grasses, as Saccharum spontaneum, I have found the attachments on both their creeping subterranean stem, and fibrous roots. On the former the protrusion of a discoid cellular mass, from the parasitic tubercles into the cellular parts of the stem, was very clearly exposed by the sections. The tiny fibres of the grasses had been in many cases imbedded in the tubercles, and looked as if they had grown

through them. With the Heptapleurums, the Sandal-wood forms larger and apparently more vigorous attachments than with those of any others, which have as yet come under my observations. Thus with H. venulosum, I found the tubercular processes measuring from three to eight lines in diameter, and forming a very distinct union with the cellular region underlying the cortical parenchyma.

In the above cases and all others that I have observed, I have been struck with the absence of any swelling or hypertrophy of the parts of the root around the parasitic attachment. This apparently indicates important differences in the physiological relations, of those cases of parasitism, as compared with the like phenomena in the Loranthi; though they may be, but the results of differences in the chemico-physical relations. Loranthi we know are utterly dependent for their existence on the supporting plant, and are thus, through the season of growth, incessantly absorbing crude or elaborated juices, thus disturbing the circulation, and causing re-actions which are very likely to induce a hypertrophied development in the surrounding parts. The Santalums, on the other hand, are but quasi-parasitic, and though as I have shown, they do form parasitic attachments, and suffer in transplantation from sites on which they are established or even by the clearing out of environing vegetation, they can, nevertheless, live, grow, and even thrive in soil destitute of other vegetable roots. This leads me to remark that parasitism seems to have been a much more essential condition of their existence in former periods than it is now. I suspect this from the copious production of the parasitic tubercles and the proportionately small number which ever form attachments, and are thus compensated for the organising force expended in their formation. In the true parasites, we find no such wasteful economy: reflect on the cases, by way of illustration, above noted of the Loranthus on the leaf of Nerium, in which, after one or two futile attempts to

effect an attachment, the development of those adhering organs ceased, and the organizing force is wholly directed to the production of lateral rhizomatic processes, so as to increase the chances of contact with suitable attaching surfaces. This is truly a remarkable morphogenetic alternation, considering the stability of the physical conditions under which it was evoked; the spontaneity, so to speak, of the change; the definite end to which it is subservient in the vital economy of the organism, verging indeed, wonderously close on those phenomena, which in the other kingdom of organic life, we dignify by the name of instinct. In the quasj-parasitic sandal-woods, there are no such economic disposition of the vegetative forces, as we find a large proportion of their parasitic tubercles, depending, loose and functionless from the roots, or at least in so far, as related to their normal function, as channels for the absorption and transmission of the juices of the surrounding plants. It is thus by no means improbable from the evident abeyance of parasitism in existing sandal-woods, and the truly prodigal production of parasitic organs (which while retaining their potentiality, by no means generally exercise the function), that they have acquired a last stage in the transition from parasites to self-sustainers. From this point of view the relationship of sandal-worts becomes less dubious, and supports the view of those systematic botanists who have correlated them with the pre-eminently parasitic Loranths. As bearing on this also the embryonic relations of the two orders as demonstrated by Griffith are of great significance, seeing, that "community in embryonic structure reveals community of descent.......... and thus in two groups," I quote from Mr. Darwin, "however much they may at present differ from each other in structure and habit, if they pass through the same or similar embryonic stages, we may feel assured that they have both descended from the same or nearly similar parents, and are therefore in that degree closely related."—*Origin of Species*, No. 481.

3. *Elytranthe.*—A considerable genus of parasitical shrubs, found chiefly in India, the Malayan Peninsula; and Islands of the Archipelago. They attach themselves to their prey by epi-cortical rhizomes, and have more or less tufted and dichotomously-branched stems, with opposite or alternate, usually glabrous, thick, and coriaceous leaves. The flowers of a greenish purple or orange colour are disposed on short axillary or lateral, solitary or fasiculate, and few flowered spikes inserted in the rachis, and each furnished with three imbricated bracts. They have an ovate calyx-tube, with a short, truncated or toothed limb, a tubular 6-cleft corolla, 6 stamens, and an inferior 1-celled ovary, containing a solitary ovule, crowned with a filiform style, and a simple stigma. *E. globosa* is a common Bengal shrub, and the only species found in the Botanic Gardens here; it is the Loranthus globosus of Roxburgh and the Choto-mudha of the natives. It is a tufted, usually evergreen, parasitic shrub, with opposite, rarely ternate, or alternate leaves, of a thick leathery texture, oblong-ovate or ovate lanceolate, acute, smooth and entire; and from 2-6 inches long by 1-3 broad. The flowers are small, of a greenish-purple colour, and borne on short, solitary or fasiclal, axillary or lateral spikes: the berry is about the size of a small pea, smooth, juicy, and viscous; firmly adhering to the bark of trees on which it germinates. The parasitic phenomena in this species are identical with those of the Loranthus longiflorus previously described, and thus require no further illustration here. As this species, however, is very generally attached to trees different from those on which the above is found, the following list may be of interest, as showing the species on which it is found in the Botanic Gardens here:

Flacourtia cataphracta	Achras sapota
Sterculia villosa	Bassia butyracea
Brownlowia elata	Mimusops elengi
Xanthochymus pictorius	„ imbricaria
„ ovalifolius	Chrysophyllum monopyrœnum
Banisteria laurifolia	Nerium odorum
Acer oblongum	Grevillea robusta
Melia composita	Camphora officinarum
„ sempervirens	Morus Indica
Mangifera Indica	Ficus nitida
Brownea ariza	„ oppositifolia
Eucalyptus diversifolia	„ lucida
Barringtonia acutangula	„ cordifolia
Careya sphærica	Bischofia Javanica
Lagerstrœmia reginæ	Casuarina muricata
legans	Salix tetrasperma

The trees which this parasite most affects in the gardens here, are Salix tetrasperma, Chrysophyllum monopyrœnum, Acer oblongum, and Bassia butyracea. Lately, however, I have found plants growing vigorously, and spreading rapidly on specimens of Casuarina muricata. The latter are only five years old, though from 30 to 60 feet in height (so quickly does this tree shoot up in Bengal) and as none of the parasite-bearing branches are more than four years old, the following measurements and details will best illustrate the favourable conditions afforded by these trees for the development of the above parasite. Specimens of only three years growth have rhizomes four feet long, by a girth of an inch and-a-half towards the base, and giving off numerous lateral ramifications, all extending outwards, and firmly attached to the bark by a close-set series of oblong suckers, the larger of which measures eight lines in length by six n breadth. On one specimen I found thirty-three branches springing out at irregular distances from the rhizomes and varying from six to

forty inches in length; the stoutest having a basal girth of two and-a-half inches. The branches are but slightly forked, and the leaves above the average size: measure from three and a half to five inches long by one and-a-half to two in breadth. Some of the other specimens have equally long rhizomes, and even stouter and longer, though less numerous branches, of which the older and lower have nearly all a sickly look, and will seemingly be short-lived. In relation to this it is interesting to observe, every rhizome extending towards the apex of the branches, and we find that even those primarily directed inwards have thus proceeded for very short distances until they turn—often very abruptly—round, and extend outwards: in no single instance have I observed the reverse. In older, sparingly branched and opener trees, this is not likely to be the rule, though, in the faint, peculiarly diffused light afforded by the close-set branches, and profussion of needle-shaped foliage on the younger trees, the conditions are evidently unfavourable to the existence of the parasite on the lower and inner branches. This is shown above by the decreasing vigour of the inner and lower stems or rhizomes of the parasites thereon. This species, though rarely found on the genus Citrus in the Gardens here, proves most destructive to some of its varieties when once fairly established, and I hear that this or an allied species often seriously infect the groves of sweet orange trees in the Khasia Mountains. Mr. Blechynden also informs me that he had some years ago a fine orange tree which was wont to yield annually a profusion of small sweetish-juiced fruits, and had thus for years been the pride of his garden. One season observing it alike barren of flowers and fruits, he after receiving some unsatisfactory explanation from his mallee, found to his disgust, that it was utterly over-run with the Elytranthe globosa: there being some little resemblance in the foliage of the two, the invasion had quite escaped his previous casual observations. Though the parasite was at once cut from the tree, the injury proved

irremediable, and it died soon after. The Overseer of the Botanic Gardens here, Baboo Prosunno C. Sein, also informs me of a large, healthy, and fruitful specimen of the pompelnose,—Citrus decumana,—in his own garden, which had become in a few years so seriously infected with E. globosa, that, but for its having been previously blown down by the Cyclone of 1864, it must soon have been killed by the parasite. The Baboo also informs me, that the fruits decreased rapidly in size, first on the infected branches, and latterly (as the parasite extended) on the whole tree, and also acquired a dry, tough, and most insipid flavour.

The more valuable of our Indian timber trees do not so far, as I have observed, seriously suffer from the attacks of the se-parasites. On Saul—Vatica robusta—I have never found Loranthi, and for Teak—Tectona grandis—though we do find them occasionally, they are not likely to cause much damage to the wood. These attacks being largely confined to the extremity of the branches in the first instance by the heavy foliage, and their subsequent extension on the older and larger branches checked by the thick outer layers of dry fibrous bark, which prove an almost impermeable barrier to the young suckers of the Loranthi. The plants established on the outer branches, though increasing rapidly in size, are rarely of long duration, their tufted compact mode of growth, brittle stems, and generally exposed position rendering them very liable to be torn off, or broken by the wind. Thus so far as my experience goes, the teak in its own leaf and bark investments, effectively resists any serious invasion of our Loranthi. On the other hand, all trees liable to become infected with these parasites, and which it may be desirable to protect, must needs be regularly looked to and promptly cleared of the invaders.

Several of our Indian species of Loranthi, however, are of a highly ornamental character, and are well worthy a position on trees suited to their growth in our gardens. To effect this,

trees of a character liable to the attacks of these parasites, (and of which we have above afforded numerous examples) should be selected, a notch cut in the bark on the north—or cooler and more shady, though airy-side of the tree, and a seed of the parasite inserted therein : care being taken that it is not crushed in the operation. In Europe the common mistleto is also frequently transferred from one tree to another by grafting and budding processes, which might doubtless be effected with the Indian Loranthi also during the rains. The mode of operation in the case of the mistleto is thus described by Loudon, and is equally applicable to our indigenous Loranthi. "Where the stock is not more than half an inch in diameter, an incision is made in the bark, into which a scion of mistleto pared thin is inserted, having a bud and a leaf at the upper end. In grafting longer pieces, a notch should be cut out of the stock ; an incision made below the notch, and a shoulder left on the scion to rest on the notch in the manner of crown grafting. In every case there must be a joint in the lower extremity of the scion. In budding, care must be taken to have a heel of wood and a joint at the lower extremity of the bud, and over all, if available, add a coating of the viscous matter from the berries, or some protecting substitute."

The Potato and its Culture: by Pratapachandra Ghosha.

This well-known and useful plant is the most precious gift of the New world to the Old. It was introduced by the Europeans into this country. The Bengali name for it still bears evidence of its origin ; *Biláti A'lu* is a foreign tuber. Though it was found in its natural state in the table-lands of the Andes of South America, we cannot assert that it is peculiar to that part of the world. We have had so many of its nearly allied species cultivated in India, from time immemorial, that it can not be positively affirmed, that it is a native of

America alone. The *Capsicum*, TOURNEF; the *Solanum*, L; the *Lycopersicum*, TOURNEF; the *Physalis*, L; the *Datura*, L; and the *Hyoscyamus*, TOURN; have representatives in the woodlands of India. Indeed, of the numerous species distributed mostly over the plains and hills of the new world, 44 have been discovered in the East Indies, *viz.* 31 of Solanum, 4 of Physalis, 1 of Anisodus, 5 of Datura, 1 of Hyoscyamus, 1 of Atropa, and 1 of Lycium. Of these a few are from the Himalayas and the rest are all tropical. The potato is still abundantly found in its wild state in the Andes, and the tubers scarcely excel a fig or an Indian plum (*Zizyphus vulgaris.*) The plants in their native soil are strong growing shrubs, about a foot high, but sometimes exceeding two. The leaves are green and healthy and the branches are covered in due season with a profusion of small, pale white or blue flowers, like those of the *Begun* (*S. melongena*) to which, indeed, the potato is near allied. The natives seem to have observed this near relationship between the tomato and the potato, for they call the former *biláti begun.* The history of the introduction of potato in the various parts of the world is remarkable. Its ally, tobacco, a narcotic plant, was known to India before the discovery of the route *via* the Cape, and became a necessary article in the economy of life; whereas potato was not at all extensively known about two-score years ago. But like the tea, wherever its use has been appreciated, it has never been abandoned. Of the many articles of vegetable food, it affords the greatest amount of nutrition. Though, when it is raw, it is held to be poisonous, but when it is boiled, it is thoroughly wholesome. A well-grown potato yields about 75 per cent. of water, 20 of saccharine matter, and about 1½ per cent. of albuminous matter. A trace of oleaginous particles is also detected in it, and the ash does scarcely exceed 1 part in 100. It is said to contain citric acid. The proportion of saccharine matter is so great, that it must be eaten with oil and albumen. It is wholesome food for cattle, and pigs have

been seen to fatten only on potatos. Indeed, this is an instance which shews that sugar taken internally, becomes oil.

The potato is a hardy plant and has a wider range of soil and temperature than any other cultivated plant, and it is susceptible of much improvement by careful cultivation and prudent manipulation. As a crop it never fails to give a return, and it will grow and produce tubers on any soil and almost without any manure. But like other cultivated plants, it soon exhausts itself by artificial culture, and, like the sugar-cane, if highly manured for a dozen of generations, it is apt to become precocious in its growth and diseased. It is superfluous to mention that as a tuber, it is a part of the stem abnormally developed to unusual dimensions, by artificial treatment, and that the whole available juice being centred in the tubers, little is left for the development of the branches, leaves, and flowers of the plant. The fact of its yielding very insignificant tubers when grown directly from seeds, is a great drawback to the ordinary farmers to renew the species from fruits. Like the individual, the species has a life which terminates after a period, depending much on the nature of the treatment it receives in its culture. Before the termination of its life, the potato gets sickly, and unless invigorated by tender culture, it becomes extinct. But how long can the struggle between nature and art last, sooner or later the plant must succumb and the particular race must be extinct. So soon as the tubers begin to shew signs of sickness, the farmers ought to import fresh seeds from other parts of the country and the old ones be left alone. It may be noticed that the variety of sugar-cane, known as the Bombay sugar-cane, had completely disappeared for some years, and it is now making its appearance as a scarce grower of our fields.

The potato loves a well-drained soil and a position well exposed to the sun. It thrives well in elevated and airy positions and in places where the changes of the temperature are not great. Sand, lime, and vegetable mould, in proper pro-

portions, give the best yield. The leaves of the plant at 212° F. yield about 15·10 parts in 100 of inorganic matter, and in 100 parts of the ashes of the same 6·81 parts of potash, 3·72 parts of soda, 1·82 parts of common salt, 40·15 parts of lime, 1·95 parts of magnesia, 1·14 parts of oxide of iron, 6·61 parts of phosphoric acid, 2·21 parts of sulphuric acid, 24·31 of carbonic acid, and 17·25 of silica have been found. To the formation of the tuber and the stem goes the greatest quantity of potash, lime, carbonic, and sulphuric acids. The following is a table shewing proportions of the above mentioned ingredients in the ashes of the tubers, stems, and leaves of the potato.

Inorganic Compounds in 100 parts of ash.

	Potash.	Soda.	Salt.	Lime.	Magnesi	Oxide o phoric	Acid.	Sulphuri	Carbonic	Silica.
Tuber ..	43·18	0·09	7·92	1·80	3·17	0·44	8·61	15·24	18·29	1·94
Stem ..	39·53	3·95	20·43	14·85	4·10	1·34	6·68	6·56	·0	2·56
Leaves ..	6·81	3·72	1·82	40·15	1·95	1·14	6·67	2·21	24·31	17·25

From the following, it will be found that the potato crop by its tubers, &c., remove a good portion of the mineral ingredients of the soil. The following is calculated for a *bighá* of land and pound in weight of nitrogen and mineral matter :

	SiO_3.	K O.	Na O.	Ca O.	Mg O.	Cl.	PO_5.	SO_3.	N.
Tubers	0·6 lb.	29·0 lb.	2·3 lb.	0·6 lb	2·3 lb.	3·0 lb.	6·0 lb.	9·6 lb.	27·0 lb.
Top	20·0 lb.	1·3 lb.	0·6 lb.	19·3 lb.	3·0 lb.	1·3 lb.	4·0 lb.	3·0 lb.	8·0 lb.

The best soil for potato available here is burnt land or what we call *kánt máti*, the earth of old walls. The quantity and quality of fecula, the nutritious matter in potato, depends entirely upon the quantity of manure applied, and as the spirit-yielding capacity of potato depends much on the fermentable matter contained in it, it is desirable that by artifical means the greatest quantity of fecula be secured in the potato. The potato is a gross feeder, and to ensure good crops about

two maunds of *khali'* (sesamum oil-cakes) and two cart-loads of cow-dung are required for a *bighá.* Lime does not appear to act in a beneficial way, though it may, in some states of disease, be applied with success. Potato prepares the soil for a crop of rice and barley, and it may follow a crop of the above with benefit, though our rice-fields are rarely rotated with potato culture. Indeed for soils immediately reclaimed from *ulu* and *kus* grasses, no crop is half so suited as the potato and the *palwal (Trichosanthes dioeca.)* This last-named plant, however sooner becomes sterile, if cultivated for more than two successive years from the same roots, than the potato, and it requires that the crop must be renewed every third year from fresh roots.

In the metropolitan districts, two varieties of potato are met with, the *disi* and *Bombay.* The first is sown here in about October and taken up in February and March. The *Bombay* variety is generally imported from the east in July and August. The former is distinguished by what we call Bombay, by its smooth rind and brighter color. The *disi* is more mealy and yields, when boiled, more starch and gluten than the kind we call *Bombay,* which feels gritty to the touch. The principal potato crops are raised in the cold season and with the *disi* seed. The other kind, however, is not frequently seen in our fields, but when grown, it is planted in July and August, and thus gives to our markets an early acclimatized potato crop. For the *disi* variety, the best of which is the *hángarmukhá,* the fields must be dug in summer, soon after the tubers have been taken up and the soil moistened with the first shower. After the potato crop is removed, the Bengal farmers plough the fields and sow seeds of *uchchhe (Momordica muricata) jhinge (Luffa fœtida),* and cucumbers by way of rotation. Before the rains set in, common farm yard-dung is laid on the soil in baskets, at intervals of four cubits, and then the soil is well ploughed and cross-ploughed with a view to mix up the manure laid on it. By ploughing and raking the ground, the

manure is intermixed with earth, and being exposed for the whole season to constant showers of rain becomes thoroughly assimilated with soil. In autumn, the ground is dug with the *kodáli* and again ploughed and cross-ploughed. So soon as the rains cease, the fields are again dug and drills are made extending from east to west. While this operation goes on, the land is freed from all weeds and roots which are carefully picked up by the farmer. In the trenches thus formed by drilling, a handful of pounded *khali* is placed, at intervals of ten inches. Immediately upon each handful of *khali* so laid down in trenches, which are thirty inches apart from each other, an entire potato *bij* as it is called is placed with the largest and the most thriving eye upwards. The drills, are then broken up and the trenches filled up to the height of former drills, so that the two change places as it were. The utility of this method of treatment may be well understood when we come to examine the nature of the plant we intend to cultivate. The tubers being portions of the stem so knotted as to form the great reservoirs of almost all the nutritive matter absorbed by the roots and leaves of the plant, they increase in bulk with the growth of the plant, and it is therefore necessary that the earth round the tubers should be of such a nature as to permit the easy increase of dimensions of the tuber. It is also necessary that proper ventilation both of moisture and atmospheric air be permitted to continue, so that the rind of the tuber as bark may have free access to both. Both these purposes are gained by setting the seed-tubers in the manner prescribed above. This system of setting in drills also facilitates subsequent top-dressing with the *niráni*, and indeed enhances beneficial effects of the latter process. This kind of treatment is beneficial to all tubers such as the *Sánk-álu* (*Pachyrrhizus angulatus*), the *rángá-álu* (*Batatas edulis*), the *kachu* (*Colocasia antiquorum*), the *ol* (*Amorphophallus campanulatus*), the ginger and the turmeric; and the experienced farmers of Bengal do not fail to follow these rules. The *khali*, as a stimulant to the young plant, prevents

the corrosion by insects. The beetles which so frequently eat up young plants before they are sufficiently grown up, do not approach such seedlings as offer a thriving appearance in the beginning. On about the fifth day after sowing, the drills are sprinkled with water and left to themselves till the shoots are distinctly visible. Abundant supply of water in the early stage is not at all necessary, but soon after the plants begin to bear leaves, say four or five in number, the potato requires water almost every week. This is supplied by what is called a *siuni*. After each watering, the drills are left to dry for about six days and after that period they are broken up and re-built a little higher than before. So by alternate water and top-dressing, the plant developes very fast, and as the stem rises in height, it is earthed up to the root of the branches. When the plants give out from four to five good strong branches, they require no further attention than occasional watering and opening of the sides. In large fields, deep pits are dug, one in about a *bighá* of land, and these are filled with water by the *siuni*. The pits are useful to the farmer in many ways, as fresh earth is obtained from them, the weedings of the field are thrown into them, which rot therein, and afterwards form an easily-made reservoir of liquid manure. The pits also save the farmer much trouble, for, in their absence, he sometimes finds it difficult to conduct the water of the *siuni* to every part of his field. The potato is fit to be dug up after the plants shew signs of decay, though for domestic use, they may be taken up earlier. In digging for potatos, a dry and a fair day is to be preferred, as those taken out in damp, cloudy, or foggy days, do not keep long. Tubers to be preserved for seed are taken out with care. The most prolific plant is selected, but the tubers are not collected till after the stem has been completely dried, though in the Gardener's Magazine, Vol. II., page 17, it is stated, that unripe tubers are said to prevent the *curl*. Each plant yields about three to four large tubers, and

these are located at the lowest part. The middling-sized ones are selected for seeds and such of them are taken as are at the neck of the stem. After collecting them from the field the tubers are laid on a bench of bamboo-slits and hung up from the ceiling of a room, well ventilated and dry. Notwithstanding all the care taken by the farmer, about a quarter of the stock kept for next year's sowing is spoiled by rotting, and he is always on the alert to pick up the ones just affected with spots. It may be observed that rotting, like fermentation, is contagious, and if those affected with dark spots are not immediately removed, the entire stock becomes spoilt. The potato gets spoilt by rain at the ripening time and the disease is called rot, and the same effect may be observed if the field is watered at that time; but this is an accidental and esoteric occurrence, it arises from external causes, and though it ultimately induces the true rot, by affecting the organs, it cannot be said to be an organic disease. The same effect has also been seen to take place by late harvest. Rot arising from exposure to the sun or from tubers being dug up in hot weather may be prevented by sprinkling air-slacked lime. In the Report of the Department of Agriculture, U. S. America, for 1869, page 332, a case is recorded where the rot was not cured the same year by that treatment, but the crop of the next year from so treated seeds became better. The potato plant is sometimes infested by bugs, and the farmers here in cases of such infection, sprinkle wood-ashes over the plant. This serves the purpose to a certain extent but the use of wood-ashes has a deleterious effect in other respects, inasmuch as they choke up the pores of the leaves to the great deterioration of the plant. In Jefferson county, West Virginia, the farmers treated the bugs with unbleached wood-ashes, as often as the bugs made their appearance, and by repeated doses, they succeeded in extirpating them. But heavy rain sometimes frees the plant altogether from them. These bugs are reported to be so very poisonous that chickens

have been found dead, it is believed from eating the bugs, which on examination were found in their crops. In De Kaleb county, Ill, they have invented a machine by which the potato-bugs are collected in a box and then burnt.* Lime-water, however, has been found more efficacious than wood-ashes. It was treated in Clarion county, Pennsylvania, in 1854, when they had very hot summer and no rain from spring to autumn. Black insects became so troublesome, that the plants were entirely denuded of their leaves and tender shoots. Lime-water was sprinkled over tops of plants and powdered lime was profusely dusted over them. In about six weeks the plants revived, and it is remarkable that, notwithstanding the injurious effects which lime has over plants the crops so treated were the best of all others.†

The greatest plague to the potato crops are, however, the minute fungi which infest them from the top of the shoots to the end of the roots, and these penetrate even the rind of the tubers. These are generated by the over-crowding of plants in fields, so that scarcely all parts of the plant have access to free air or the invigorating sun-shine. From over-crowding, the damp of the soil finds no outlet for evaporation, and the minute tubular fungi are soon generated in portions of the branches touching the earth. These are propagated with great rapidity and in about twenty-four hours they cover the entire plant. The usual preventive measure is to plant the tubers a little apart, so that the branches of one plant may not overlap those of another; but an efficacious cure seems to be a careful sifting of the soil by the *niráni* so that fresh portions are exposed to the sun. By far the better plan, however, is to stick in the soil about eight or nine pegs of iron according to the dimensions of the field.

In October last, when I made the first sowings of cabbage

* Report Department of Agriculture, U. S. A., 1867, page 244.

† Report Department of Agriculture, U. S. A., 1867, page 332.

seeds, in shallow pots, to secure an early crop, the damp air and heavy rains which came on for some successive days, combined with close and warm atmosphere, created conditions favorable for the generation of fungi and all the pots were covered over with mealy-looking minute tubular fungi. The small and delicate seedlings became immediately yellow and began to droop. I exposed the pots to sun-shine which came on about two days afterwards, but with partial success. The next day nails of iron were stuck into the soil of the pots and in about twelve hours all the fungi disappeared. My pots were never more infested with them so long as the nails were on them. In sub-terranean caves of Paris, where edible fungi are cultivated, the greatest care is taken to pick out the least portion of iron nails or broken iron horse-shoes from the beds of horse-dung. Should any bit by chance escape detection, the bed does not put forth a single fungus.

The size of the potato depends principally on the treatment the plant receives in its cultivation and entirely on the size of the seeds set in. As the quantity of fecula and nutritious matter in the potato varies directly as the size of the seed set in, it has been the aim of the potato-fancier to select always the largest ones for setting. Entire tubers, when set apart, give about half more yield than otherwise.* But the sowing of the entire potato of the largest size involves a great deal of expense and waste, when the same potato can bring forth as many plants as there are eyes on it. Pieces from large potatos, each bearing an eye when set in the same way as the entire potato is done, generally give similar yield. But in this case the pieces have to be dried in the section before laying them down on earth. Some, however, go so far as to scoop out only the eyes from the largest specimens and sow them. A little portion of the pulp in the shape of a wedge adheres to the eye which sprouts out to a plant, apparently as

* Horticultural Transactions, London, Vol. VIII.

thriving and hale as those produced from entire potatos, and the yield has been in most instances as good. It must not be forgotten, however, that the young plant before it throws down roots, depends entirely for its growth on the starch contained in the adhering portion and the more limited the source of supply, the weaker gets the plant in its youth, and even should the stimulating influence of the manure be so strong, as to counterbalance this deficiency, the artificial exertion which the plant undergoes in its youth tells heavily on its vital force. It, indeed, lessens its life, and ere long, it shews signs of old age and decay.

It has been stated above that like the individual the variety and the species have a life which terminates at a period however distant it may be. The potato may also be considered as an individual plant which has extended itself to so many tubers, some hundreds and thousands in number, and when the division of the original impetus of vital force given to the ovum by the pollen in the formation of the seed, has been so extensive, that each individual tuber holds but a fraction of a high denominator, it is natural to suppose that the vitality of the tuber should come to an end. Indeed, the phenomenon is more remarkable than the almost unique parthenogenesis of the Aphides. By accidents such as tender culture and high manuring, the vitality may be extended to an indefinite period, so that like the approach of an asymptote, it may be continually divided without ever approaching zero. Yet we know that the sum of the series of approaches when carried on to infinity, will bring the line to touch the curve. But how numerous are the chances which may bring the thing to an end, how many circumstances interfere towards the shortening of life it is difficult to say. We have not the means at our command to determine the true cause of decay, but is it not probable that by long-continued culture of the tubers from the same parent plant, we develop particular mineral deposits in the tuber

itself, so that vitality can no longer be sustained, in the way the deposition of silicious matter in the fibres of the palm and the unusual thickening of woody fibre in other dicotyledonous trees bring them to an end.

The potato, when cultivated in the same soil, yields a better crop in the second year than in the first. Indeed, the potato growing capability of a field may be lengthened to an indefinite period by judicious manuring and rotation of crops with the cereals. This fact, it is believed, induces the farmer to place undue confidence in the capacity of the soil and to go on cultivating the tubers without change of place or variety. Conditions unguarded against, gradually creep in and at last decay breaks out in the form of a rot. This has been observed to appear all on a sudden and seems to affect several fields and even whole localities at once. In the sixth volume of the journal of this Society, p. 10, is recorded a similar out-break of rot in the potato crop all over India in 1847. Spotted specimens and specimens rotting by black spots were subjected by Dr. W. B. O'Shaughnessy to chemical test, and he reported that he discovered nothing wrong in the other portion of the potato. The same were examined under the microscope by Mr. Grant, with the same result. In 1868, a similar outbreak was noticed in North Carolina, Haywood county, where formerly potato was very good.* Mr. W. Taylor, of Renfrewshire, in his elaborate monograph entitled "Potato Disease: its cause and cure" attributes the disease to causes similar to those mentioned in the Report of Department of Agriculture, U. S. A., for 1868. But as these causes are only of an accidental character, they cannot be admitted to account for a general out-break. For a detailed list of the causes, the reader is referred to the above-mentioned report, in which the subject has been fully treated. The general out-break of disease must be referred to some general causes. It has now been established

* Report Department of Agriculture, U. S. A., 1869, page 394.

beyond question that plants propagated by the division of roots or tubers, wherever placed, unless under dissimilar circumstances, present at the same time the same symptoms of growth and decay. The bamboo has been seen to blossom the same year throughout many localities, and this display of flowers, though not periodical with particular stem or group, is no doubt periodical with the same group and with other groups derived from the same. The potato or the bamboo wherever placed, unless the conditions of the soil and temperature be quite dissimilar, may be considered as so many branches of the original parent stock, in short if the localities were not very distant, they may be considered to form a wide-spreading plod of *durvá*, and when some important phenomenon of growth or decay occurs in the parent stock, the entire plod is more or less affected.

It would be judicious, therefore, to raise new varieties from seeds of the potato plum, so that we might have, without interruption, a continual supply of the best potatos. The first year's tubers raised from the seeds are not large enough for domestic use, but in the second year, the sowings from tubers are sure to give a better yield ; or were it worth the trouble to engraft eyes from old known potatos on those directly raised from potato-plums, the second year's crops ought to give as good and large yield as the oldest potato, and that without the disease.

Potatos may be improved by shifting seed. A farmer in North Hampshire planted in 34 hills, 17 potatos, weighing 4¾ lbs., which were raised 200 miles from his farm, and in the same hills he also planted the same number and weight, of the same variety which had been grown in his farm for 12 years, the rows planted side by side received the same treatment. The yield of the new seed was greater in number, size, and weight than that of the old. The following will show the respective yields in exact figures.

		New Seed.		Old Seed.	
		Number.	Pounds.	Number.	Pounds.
Large	...	423	102	350	82
Small	...	630	32	780	51
		1,053	134	1,130	133

This fact at once shews the necessity of trying new seeds. In Bengal, we do nothing of the kind, and our potato crops though they have not up to this day failed altogether, show signs of gradual deterioration.

Accidental diseases may be avoided by drying potato seeds before sowing them. The rind of the potato is so hard and impervious, that Messrs. Wasileffsky of Mohileff and Losovsky, of Witebek, in Sebege, heated the seeds to 72° and 136° Reaur. thermometer, and still the vitality was not affected.* Potatoes have been improved also by galvanism by Mr. Haworth† and acclimatized seeds were planted in Darjeeling which gave good fecula.‡

A few Notes regarding the Khoosroo Bagh at Allahabad,—its past and present condition.

Availing myself of a week's holiday, during the last Doorgah-poojah vacation, to visit a portion of the Upper Provinces, I took the opportunity, whilst at Allahabad, to spend a short time at the *Khoosroo Bagh,* the public garden at that Station. In these days of easy travelling, this garden is now probably much better known to residents of Bengal, than formerly; but as there may be some of the readers of the *Journal,* who have not had an opportunity of visiting

* Journal, Agricultural Society of India, vol. VIII., p. 157.

† Journal, Agricultural Society of India, vol. IV., p. 38.

‡ Journal, Agricultural Society of India, vol. X., p. 66.

it, a few lines, descriptive of my several inspections, may not be uninteresting.

I could not gather any authentic particulars as to the early history of the garden, beyond that it dates from the time of the Emperor Akbhar, by whom it was formed; and is therefore upwards of 300 years old. There are three Mausoleums in the centre of the garden, which are shaded by several splendid tamarind trees, about the finest I have seen: these were probably planted at the time when the tombs were erected.*

The garden is a perfect square; it is bounded by a stone wall 20 feet high, now partly covered with gigantic creepers. This wall is in as perfect a state now as when built, proving the excellence of the materials employed in cementing it.† The area of the garden is 65 acres, about one-fourth of the size of the Royal Botanic Garden, Calcutta. Till recently, it had been, apparently, neglected for a long time; it still bears in many parts the remains of such neglect, and it will require much care and expenditure

* "In the middle of the Bagh are three Mausoleums; two over the Princes Khusroo and Purvez, and a third over the Marwaree Begum of Jehanjeer. The tombs are all on the model of a Mahomedan *Tazia*. The one belonging to the lady has a little peculiarity in distinction of her sex.

"The ill-fated Khusroo lies between his mother and brother, and has the grandest tomb among the group. His remains are interred in the vaulted chamber, round which spreads a square terrace forming the first stratum of the building. The small size of the sarcophagus confirms the death of Khusroo, in an early age. The walls of the lofty octagon rising in the middle are outwardly ornamented with many decorations. The interior is beautifully painted, in which some of the foliage and flowers still retain their dye. The dome on the top swells beautifully out into a faultless globe." *(The Travels of a Hindoo, by Bholanauth Chunder.)*

† There was some talk, when I was at Allahabad, of lowering this wall and placing an iron railing thereon. This would certainly open up the garden to the view of the outside pedestrian, and give it a less confined look; but the cost would be very great, in the labor required for reducing a wall of such thickness and strength, in addition to the cost of the railing.

of money before it can be made what a public garden at the seat of the Government of the North-West Provinces should be. Formerly a single road ran through the garden, from the North Gate opposite the Railway to the South, and which opens on a large *Serai,* through which the great road to the Fort passes. This *Serai* is now used as a market, and the numerous apartments are either let out to natives or granted as rewards for good service in the mutiny. The gate from the *Serai* into the gardens is a fine specimen of Oriental workmanship; it is made of Teak *(Tectona grandis)* and shows no signs of decay, though probably exposed for three centuries to an Indian sun and rain. Originally the main road, and a portion round the tomb, was the only part laid out as a garden. There are six large wells in the garden, and two outside the wall, but connected with the garden by means of stone aqueducts, which extend all along the wall. The water has to be brought to the surface from a minimum depth of 70 feet, which is a great drawback.

As already mentioned, the garden had been sadly neglected for several years. Many beautiful trees had also been cut down; even some of the fine tamarinds were not spared. Cattle were allowed to roam at pleasure over the whole garden; rank jungle and filth occupied the place where trees and shrubs should have been. Any one who has taken the least interest in gardening in India, knows the result of even one year's neglect. What then must have been, till recently, the state of this fine piece of ground, after several years' inattention. Fortunately, about two years ago, the garden was placed in charge of Mr. Samuel Jennings, (late a Vice President of this Society). Although much remains to be done, especially in the more retired parts of the garden, it is gratifying to see what has been effected during the comparatively short time Mr. Jennings has had the superintendence. He has constructed a road round the garden, nearly a mile in length, 50 feet broad, lined throughout with valuable trees,

mostly from Calcutta and Saharunpore. Border gardens have been made between the road and the wall on the North and South side of the garden, aggregating rather more than two thousand feet in length, and 30 feet in width. Originally there was a Maze in too prominent a position; this has been moved to the N. W. corner of the garden. In the place of the old Maze, a Rosarium has been formed, and stocked with good plants, which thrive exceedingly well in the climate of Allahabad, as well as at Cawnpore and Lucknow, far better than in the climate of Bengal. We are indeed far behind the N. W. Provinces as respects Roses.

Opposite the entrance of the garden a Fernery has been formed, under the shade of two fine jack trees, (*Artocarpus integrifolius*). These are filled with beautiful ferns, intermingled with *Tradescantia zebrina*, the thorny *Euphorbias* and *Cactus* plants. After passing a circular lake (also a new work) 180 feet in diameter, on the left, the road passes between two loop borders, prepared for winter annuals, behind which are double rows of choice roses. There is also an avenue of *Araucarias* which had been only put down a short time previous to my visit, and the majority were then looking sickly. These have since, I am informed, taken kindly to their new position; and when they have attained fair proportions, will prove a most ornamental addition to the garden. An old Vinery was found to be in existence when Mr. Jennings took charge, but in a ruinous condition. This has been replaced by a new Vinery in the North-East corner of the garden, of a cruciform shape, of red brick; each passage is 70 feet long, and entered under a fine pointed arch, which gives the whole the appearance of a ruined Abbey. The centre wall is to be surmounted by a dome of trellis work.

In front of the tombs, already referred to, there is a circular garden laid out in modern English style, with alternate beds of geraniums and fuchsias, the latter looking

strong and healthy. Other beds were filled with heliotrope; and daisies, mimulus, mesembryanthemum, sweet-peas, broccallias, &c., were to be added.

A temporary plant-house has been constructed for sheltering the more delicate plants from the sun by day, and from the frost at night in December and January. In this house, I saw a fair collection of Palms, Crotons, Dracœnas, Geraniums, Caladia, Begonias, Ferns, and Orchids. Among the latter are included several fine examples of *Phalænopsis* of seven or eight species; the Orchids in general looked in such good condition, as to hold out a prospect of being successfully cultivated even in the dry climate of Allahabad.

The improvements already effected give promise of what the garden will become, if continued for a few more years under the same energetic superintendence. Much, has already said, has been done, but much remains to be performed to bring a spot of 65 acres into good condition. There are some spots which are covered with splendid mango and other trees; and although some of these appear to be in the way of general improvement, it would be a pity to cut down such fine specimens. But there are other smaller trees of various kinds which might, I think, be removed with advantage, to open up the part round the building, where the Superintendent resides, and thus allow a freer circulation of air. Altogether the future of the Khoosroo Bagh looks hopeful.

Before concluding this brief notice, I may add that I saw several other pretty gardens in this large Station. The one attached to the house occupied by Mr. Mayne, the Commissioner, is laid out with much taste; and another, belonging to Mr. Waterfield, contains a large collection of ornamental plants, most of which have been introduced by him, and all seem familiar to him.

A. H. B.

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CORRESPONDENCE AND SELECTIONS.

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MDCCCLXXI.

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Part II., Volume II.

Correspondence and Selections.

REPORT ON THE GERMINATION OF AUSTRALIAN FIELD SEEDS: BY F. HALSEY, ESQ.

I have the pleasure to hand you report of the Australian Field Seeds, received from you last October.

The percentage of germination given, with the list herewith sent you, is the result of two sowings made in October and November, 1869, in seed pans, the actual results were not so good with the exception of the tares and grasses. The turnips were bad—before sowing them, I knew they would not germinate. The carrot seed, also, was not good, as although, it partially germinated in seed pans, very little did in the open, but what did grow was fine; the same may be said of the mangel, but mangel to be of any use should be sown in the Punjab in August or before 15th September. The clovers are only suitable for garden cultivation. The perennial rye and Prairie grasses grew beautifully; I have no doubt I might have cut them three times before this, had not I wished to keep them for seed, of which I have collected a large quantity. The lucerne, I have already had three cuttings of, each 18 inches to two feet high, and expect to get two more before the rains commence. It is not, however, killed by the rains in this part of the Punjab. I hope also to save the perennial rye and Prairie grasses through the hot season.

The oat seed was magnificent to look at, and although apparently good to taste and smell, absolutely refused to germinate; the barley the same. The wheats were not in good order; it was apparent to the eye that much would not germinate. I have not reaped it yet, but when I do, I will test them against several different sorts of Punjab wheats and let you know the results. As far as I can judge at present, they are infinitely superior to anything in this country both as to weight of grain and length of straw. I shall distribute the greater part of the seed amongst the cultivators in this neighbourhood, and next year will let you know the result.

Umritsur, 2nd May, 1870.

No.	The Nos. borne on the several packets of seeds correspond with the No. given in this list.		Report on result of Sowings	
1	Grey Stone	Turnips.	Seed bad, did not germinate at all. But all these sorts will grow to great perfection in the Punjab.	
2	Purple top Scotch Yellow ..			
3	Green top ,, ,,			
4	Carter's Purple top Swede .			
5	White Globe			
6	White Strapleaf			
7	Altringham	Carrots.	10 pr. ct. germinated	All suited to the Punjab.
8	White Belgian		10 ,, ,,	
9	Newark Improved ..		20 ,, ,,	
10	James's Intermediate ..		nil ,, ,,	
11	Dutch Horn		10 ,, ,,	
12	Long Red	Mangel.	10 ,, ,,	Perfectly suited to the Punjab
13	Red Globe		10 ,, ,,	
14	Yellow Globe		20 ,, ,,	
15	Golden	Tare.	100 ,, ,,	Should be sown in August Grow with great luxuriance in the Punjab.
16	White . ..		100 ,, ,,	
17	Trifolium incarnatum ..	Clover and others	10 ,, ,,	Suited only for garden cultivation.
18	,, hybridum ..		nil. ,, ,,	
19	,, pratense ..		30 ,, ,,	
20	,, pratense perenne		nil. .. ,,	
21	Perennial Rye	Grasses.	Every seed grew; 21, 22, and 23 highly desirable introductions; 24 grows beautifully, but gets killed when the great heat comes on.	
22	Prairie . ..			
23	Lucerne			
24	Lawn			
41	Potato Oats		Not one seed germinated.	
42	English Barley		,, ,,	
43	White Lamas Wheat ..		20 per cent germinated.	
44	Purple Straw ,, ..		60 ,, ,,	
45	Red Tuscan ,, ..		60 ,, ,,	
			The produce of wheats magnificent: every cultivator who sees it desires seed.	

The Improvement of seed by selection. Communicated by J. G. Robertson, Esq., *Assistant Settlement Officer.*

I have despatched to you, by parcel post, a specimen, (weighing 1 oz.) of wheat, grown by me in Boolundshuhur.

Two years ago, an old Shaikh who had made it his hobby, year by year, to pick out the largest grains produced in his village, sowing these again, to make a careful selection, presented a friend of mine, resident in Boolundshuhur, with some twenty grains. These my friend sowed in his garden, and from the produce gave me about one-eighth of a seer of the grain.

I sowed my seed on 20th November. I should have sowed earlier, but had no opportunity. The soil was ordinary Domut soil (a mixture of loam and sand) of fair quality, and had been

moderately manured. It was watered from a well, seven times during its growth, and received three showers of rain, averaging half an inch each. I reaped it on 10th April.

The seed was sown singly at intervals of two feet, in drills, two feet apart. The shoots produced from each seed varied in number from 35 to 98, that is to say, the largest looking bunch numbered 98, and the smallest 35. I did not count all. They rose to the height of over six feet. The length of the ear, without the beard, was four inches; with the beard 12 to 14. I sent a specimen of the ear to a competent Botanist, Doctor King, Assistant Conservator of Forests, Kumaon, enquiring what kind of wheat it was. He replied "the sample sent, is simply a very highly-cultivated ear of country wheat. The ear is a splendid one."

The grain when threshed, weighed a little under three maunds. The bhoosa, when dried by the hot-winds of a few days, weighed over nine maunds.

The land in which it was sown measured one-tenth of an acre. This would give an out-turn of nearly 30 maunds of grain and more than 90 maunds of bhoosa per acre. I could have sold the wheat for 12 seers a rupee in the bazar, the price of common wheat then being 16 seers a Rupee.

The appearance of the crop, before it was ripe, was more like that of sugar-cane than ordinary wheat. Its leaves were broad and of a dark green color, and though sown so widely apart, one could not detect any unoccupied space. I do not consider that the experiment was tried under too favourable circumstances. The results, as above-mentioned, were obtained notwithstanding two serious obstacles, 1*st.* a shower of hail, accompanied by violent wind, the former of which did considerable damage, the latter *laid* it, but I think did not injure it much; 2*nd*, loss from eating by sparrows.

It does not appear that sparrows particularly affect ordinary wheat. They were so violently fond of mine, that, had I not stationed a boy to watch it, I should have lost it all.

The former obstacle is only occasional; the latter will always exist. I intend next year trying the experiment on a large scale; and I should like to see what would be the result in the hands of others. If the Society think it worth while to make it known, I shall be glad to answer any requisition from those who take an interest in the matter.

Meerut, 16*th May*, 1870.

Suggestion for the introduction of Fruit Trees with ornamental blossoms into Flower Gardens: by HENRY COPE, ESQ.

It has frequently occurred to me, and I think I have somewhere given utterance to the thought in my miscellaneous and somewhat extensive correspondence with you and your Society, that much might be done to render gardens more useful than they are, without detriment to their appearance, by the extensive introduction of fruit trees into those which have hitherto been merely ornamental, where we now only resort to flowering shrubs and trees, which though very elegant and beautiful, have nothing but their flowers to recommend them, whilst fruit trees and shrubs have the great advantage of having both beautiful flowers and useful fruits. If I have not dwelt in writing on this subject, I certainly carried out my notion in my garden at Umritsur, for I found, by practice, that few plants can compare with a peach or apricot in full bloom, while all the plums would be a sight in themselves. I am therefore not surprized to see that the same idea is just now receiving countenance in Europe, and for the first time, as it would appear, by a notice in the *Revue Horticole* of Paris. The second number for March of this year has a paper by Mons. Alfons Cresmael, of Mons, in Belgium, giving his views on the subject, illustrating them with a sketch of a garden recently laid out by him on a plan of the kind. By a judicious admixture of fruit trees and shrubs with beds of annuals and flowering perennials, he has produced a novelty which he believes, and the Editor thinks most justly believes, will secure a striking effect.

I venture to bring this subject to the notice of our Society, because I think much might be done in the same direction in India, where such beautiful plants as the loquat combining fragrance and elegance (its foliage alone commands a prominent place) when in flower and fruit; the various kinds of plums, the peach (especially the China flat) the almond, and others might be extensively utilized in gardens if judiciously intermixed with purely ornamental plants; while, to add to the effect, climbers or creepers, coming into flower after the fruit has been gathered, might be planted within reach of the trees to keep up the ornamentation, as it were during an entire season.

Besides this, a disposition of this nature would have the almost certain effect, of securing the permanence of many gardens which might otherwise be neglected by new tenants, who would think it worth while to keep up a productive piece of ground attached to their houses which they would ignore as a mere matter of taste.

If you think the suggestion deserving a place in your Proceedings, oblige me by reading this at your next Meeting, and say for me how glad I shall be at all times to be of any service to the Society.

Experimental trials with Japanese Silkworms in Bengal: by M. G. DeCristofris.

In reply to your favor of the 13th instant, and in continuation of my letter of the 21st March ultimo, [See *ante*, p. 23,] I beg to give you further particulars on the rearing of the Japanese silk-worms, which I regret to say, has proved a total failure.

The seeds in small quantities were given out to several natives in April last, for the purpose of doing the experiment in a more practical manner. These rearers, native-like, took little or no pains with the worms, and eventually allowed them to be nearly all destroyed by that large grey fly which is so great an enemy to all silk-worms during the hot season. In consequence of this failure, I could only collect a very few healthy cocoons to try a third re-production of the eggs; but I am sorry to say owing to the great dryness in the weather, and, perhaps, for other causes difficult to be ascertained as yet, not a single moth bit through, thus closing an experiment (which promised very fair) to a most unsatisfactory end. Other Europeans have tried the experiment with the same worms, and have met with the same result as myself; and I am therefore of opinion that the Japanese worms will not answer for the purpose of rearing in the climate of Lower Bengal.

From the first re-production there were some eggs that, from their size and color, and not hatching at the same time as the rest, appear to me to be the real bivoltines, or altogether annual. These are yet on hand, and have still a healthy look, and very probably may be hatching in the next cold weather. Of these, I have the pleasure to send you a small quantity herein, which I trust will answer your purpose of sending them to your friend at Mussooree.

Gadee, viâ Jungypore, 20th July, 1870.

Report on Horse Gram, (Kooltee), Dolichos Uniflorus, cultivated as a green Fodder-plant under dry cultivation.

This plant belongs to the order Leguminosæ, the order which includes beans, pease, vetches, and clover. It is a hardy plant, and thrives on the poorest soils.

2. The soils of this district contain a very small proportion of lime; and this plant, like all leguminous plants, requires a good deal of lime before it can mature its seed. It has been ascertained from experiment, that unless the manure applied contains a considerable percentage of lime, the tendency of the plant under better cultivation, *is to produce leaf*, rather than seed; this tendency has been utilized, and by deeper cultivation

and the application of medorate dressing of manure we have succeeded in growing good fodder, at a very moderate cost.

3. During the past eight months, on this Farm, we have cultivated nearly twenty acres of gram, simply for green fodder, and though the weather during the past six months has been extremely dry, the results have considerably exceeded our expectations. In proof that our circumstances are not of a favorable character, I need only mention that our soil contains eighty-nine per cent. of sand; and that, with the exception of a shower on the 17th February, we have not had a drop of rain during the past sixteen weeks. Our first crop was sown on the 3rd of August; we commenced cutting this crop on the 13th October; the yield was 10,642 pounds or 4 tons, 15 cwt., 8 lbs. per acre. No manure was applied in this instance, as the soil was in good condition. The crop was ready for cutting at least two weeks before it was harvested; the actual time required in coming to maturity was, therefore, only two months. During showery weather the crop reached maturity in six or seven weeks; from the results of my experiments during the last eight months, I am convinced there is no difficulty, in this district, in growing four crops between the first of August and end of April.

4. In preparing the soil for the gram we proceeded as follows:— Ploughed 5 or 6 inches deep, harrowed across the line of the plough; spread about 5 tons of manure per acre broadcast over the land: ploughed in the manure, and then levelled the plough furrows with the chain harrows. The seed was then sown in lines, varying from 18 inches apart, according to the season and quality of the soil; if the season was unfavourable, and the soil poor, we placed the lines closer together, if the season was favorable, and the land in good condition, we placed the lines further apart. We sowed the seed at the rate of from 30 to 40 pounds per acre. After sowing, the chain harrows were passed over the surface and covered the seed. One application of manure will suffice for the four crops. It is necessary to hoe the crop during its growth. We found two bullock hoeings and one hand hoeing sufficient for each crop.

5. The crop should be cut immediately the flower appears, and removed from the ground at once; the land should then be ploughed and re-sown on the same day. It is very necessary *to sow immediately after ploughing*, for, if the moisture is allowed to escape, the gram will remain a long time in the soils before germinating. Once get the gram above ground, and the crop is comparatively safe.

6. When cut before maturing its seed, the cultivation of gram improves rather than impoverishes the soil. True, there will be a slight loss in the mineral constituents of the soil; still, as this plant appropriates such large amount of atmospheric food,

and stores it away in its roots, and as these roots, weighing from eight hundred to one thousand pounds per acre, are left in the soil, its condition must be improved.

7. The crops grown during the past three months did not yield so much fodder as those grown during or immediately after the rains; however, they yielded:—

7,582	pounds	per Acre.
6,969	do.	do.
4,355	do.	do.
6,480	do.	do.
5,614	do.	do.

or 6,200 pounds per acre. As I have previously stated, we have grown crops that *yielded 50 per cent. more fodder*, and I might fairly record the average for the whole season at 25 per cent. above this result, however, I prefer taking the lower figure in my calculations, as the more certain.

8. The cost of producing one Ton of Gram-fodder is as follows:—

	Rs.	A.	P	Rs.	A.	P
FIRST CROP.						
1 Ploughing	1	0	0			
1 Harrowing	0	2	0			
5 Tons of Manure	5	0	0			
Spreading "	0	2	6			
1 Ploughing	0	12	0			
1 Harrowing	0	2	0			
35 Pounds of Seed	0	12	0			
Sowing	1	0	0			
1 Chain harrowing	1	2	0			
After Cultivation.						
2 Bullock hoeings	1	8	0			
1 Hand hoeing	1	0	0			
1 Cutting	0	8	0	12	0	6
SECOND CROP.						
The same expenses less cost of Manure, etc.				6	14	0
THIRD CROP.						
Same as last				6	14	0
FOURTH CROP.						
Same as last				6	14	0
				32	10	6

Thus, four crops, each yielding 6,200 pounds, gives total of 24,800 pounds of green fodder, at a cost of Rupees 32-10-6, *making the cost of one* Ton Rupees 2-15-1.

9. A crop of gram may be obtained before the regular cold season crop is sown; thus, if sown in the early part of August,

it will be ready for cutting in the first week of October, or it may be grown after the removal of the regular crop. Last season we had two crops of gram-fodder, and one crop of maize, off one piece of land. The gram was sown in August and reaped in October; the maize was sown in October, and harvested in January; the second crop of gram was sown in January and was ready for cutting in April.

10. The following experiments were made to ascertain the *feeding value of Gram-fodder*:—

(a.) On the 2nd of February, two Bullocks were put up to feed; one was fed on grass, and the other on gram-fodder; each animal received besides, 2 lbs. of maize, 2 lbs. of cake, and 1 lb. of flour daily. The animals were weighed at the end of every ten days; the following are the results:—

Date of Weighings.		The Bullock fed on grass.	The Bullock fed on Gram-fodder.
		Pounds.	Pounds.
February	... 2	384	360
Do.	... 12	406	375
Do.	... 22	415	375
March	... 4	423	388
Do.	... 14	431	396
Do.	... 24	430	403

The animal fed on grass increased 46 pounds in weight, and, that fed on gram-fodder increased 43 pounds. The former gave an increase of 11·97 per cent., while the latter gave an increase amounting to 11·94 per cent. *Practically, the results were the same.*

(b.) At the same time, two pens of sheep, each containing five wethers, were put up to feed. One lot was fed on grass; and the other lot on gram-fodder; besides this, each lot received daily 5 lbs. of maize, 5 lbs. of bran, and 5 lbs. of cake; at the end of every ten days each lot was weighed; the following are the results:—

Date of weighings.		Five Sheep fed on Grass.	Five Sheep fed on Gram-fodder.
		Pounds.	Pounds.
February	... 2	230	200
Do.	... 12	232	201
Do.	... 22	228	196
March	... 4	240	207
Do.	... 14	242	224
Do.	... 24	242	229

The lot fed on grass only increased nineteen pounds in weight, whilst the lot fed on gram-fodder increased twenty-nine pounds. The grass was the ordinary hurrialee grass, such as is collected by grass-cutters for horses. At the usual rate paid to grass-cutters, this grass costs *ten rupees per ton*. The gram-fodder, as I have already stated, *only costs three rupees per ton*.

11. Gram-fodder may be made into hay; when well made, the hay has a pleasant aromatic smell. It is readily eaten by horses. I have had no opportunity of experimenting with it in feeding horses; but several gentlemen. who have tried it on my recommendation, speak very favourably of it. One ton of the fodder makes about five Hundredweight of hay. One ton of the hay will therefore cost about fifteen rupees.

Summary.

1. Gram is easily grown; it will grow on the poorest soils.

2. When well manured and properly cultivated, it answers all the purposes that vetches do in the practice of the British Farmer.

3. A piece of fresh soil produced in two months a crop averaging four tons, 15 cwts., 8 lbs. per acre.

4. Five crops, *grown without any rain-fall*, gave an average yield of 6,200 pounds per Acre.

5. The seed may be sown at the rate of 35 lbs. per acre, in lines, 20 inches apart, and about two inches deep in the soil.

6. The crop should be cut immediately the flower appears.

7. When cut before maturing its seed, gram improves rather than impoverishes the soil.

8. Four crops may be grown during one season, producing 10 tons of fodder at a cost of 2 *rupees* 15 *annas and* 1 *pie per ton*.

9. A crop of gram-fodder may be obtained either just before, or, immediately after, the cold weather crop.

10. Gram-fodder is as nutritious as hurrialee grass, and costs only 3 *rupees a ton;* whilst the grass costs 10 *rupees*.

11. Gram-fodder may be made into hay. One ton makes about five cwts., and the cost per ton is about 15 rupees.

(Signed) WILLIAM ROBERTSON.

Government Experimental Farm;
Sydapet, Madras, May 21st, 1870.

Orchid Culture.

In reply to your correspondent, I beg to say that I shall be glad to give such information as lies within the scope of two or three letters, concerning the locality, and the climatic and atmospheric influences, under which the Burmese Orchids, known by me, are found.

With this object, then, I will divide, as far as the varying distribution of these plants will permit, those growing on decided low levels (the plants) from those found on the hill ranges, naming only such plants as are generally worthy of cultivation in England.

The Orchids which come under notice here, taking Moulmein and Rangoon as two points of departure, will have a range of 300 to 400 miles, and as several names of towns and other places will be mentioned, those interested in this question would do well to consult a good map on a large scale, when the names will, in most instances, be detected, and the general character or features of the ground seen.

The rain-fall at Moulmein not unfrequently exceeds 220 inches between April and November, and I have, within my experience, known 6 inches, or one-fifth of the yearly rain-fall of England, to fall in 12 hours. At Rangoon the rain-fall is somewhat less, not, however, of such a difference as to exclude the growth of the same plants, with few exceptions, as are found in the vicinity of Moulmein. The flora of these districts is nearly identical. Moulmein, from its proximity to the sea, is refreshed in the hot weather by cooling moist sea breezes, and therefore is not subject to the same amount of dry heat in summer as Rangoon, which is more inland.

There are two plants found at Moulmein, never seen elsewhere by me in Burmah, and these two are Phalænopsis Lowii and Cypriepedium concolor. Phalænopsis Lowii is unquestionably a very rare plant, as difficult, I should think, to grow as it is to find. I had always been under the impression that the Rev. Mr. Parish was the first discoverer of this graceful little plant, but since I have been in England, I have been informed that that indefatigable collector, Mr. Lobb, sent dried specimens to Messrs. Veitch; however, be that as it may, the credit of introducing living plants is due to Mr. Parish, and well he deserves it, for it is a perfect little beauty of elegance and grace when seen growing in its own habitat. It is found on the limestone rock near Moulmein, approached from Moulmein either by the Salween or Gyne rivers. These rocks, vast masses of carbonate of lime, rise out of the plain abruptly to the height of above 2,000 feet; consequently the rain clouds are attracted thereto, giving the

mountains and their vicinity an extra degree of moisture as compared with more open plains.

On the same rock, but in a different position, and under peculiar conditions of growth, is found Cypripedium concolor. Phalænopsis Lowii is seated on the rock, receiving not only the direct downfall of rain, but also the drainage from the mountains above. Cypripedium concolor is found not only in shady places on the limestone rocks, but at this spot, and also up the Attaran River, growing on a stalactite formed by the filtration of water through an arched cavity in the rock. I would mention that Adiantum Parishii may also be found here in abundance, as well as at or near the top of the Thakabui Mountains, its only supposed place of growth. *Vide* "Hooker's Species Filicum," vol. ii., p. 238.

These mountains at the latter end of the rains are objects of great attraction to botanists. They are at this season covered with a luxuriance of vegetation. Ferns, mosses, orchids, &c., crowd on the rocks and trees: Platycerium Wallichii of gigantic size, with its pendent fertile fronds, and Drynaria quercifolia, of proportionate dimensions, may be seen. Again, visit these parts after the rains have ceased, and the sun will have been playing his part, doing what is termed in England a little "scorching."

Between November and March, vast changes have taken place. The pendent fronds of Platycerium Wallichii have shrivelled to nothing, the upper frond dried as a dead leaf. Phalænopsis Lowii, waving in all its splendour, in full flower and leaf in October, cannot be seen; the roots only left and attached to the rock when, in exposed places, from the absorbed heat, would be hardly bearable to the hand. The stalactite has ceased dropping; in fact all Nature seems drooping and fading from excessive heat.

Dendrobium fimbriatum, D. Farmeri, D. barbatulum, D. nodatum, D. formosum, D. Dalhousianum, D. albo-sanguineum, D. moschatum, D. chrysotoxum, D. aggregatum, Saccolabium curvifolium, S. Blumei, Aerides Lobbii, A. rosea, Vanda gigantea—each may be said to have a range of distribution from lat. 14° N., to 16°. Amongst these, I will also include Dendrobium lasioglossum and Saccolabium ampullaceum. Yet they are found in a somewhat drier locality, nearer Rangoon than some of the above. I will also mention that I have found D. albo-sanguineum and Dalhousianum, together with D. Parishii and chrysotoxum, extending at intervals from Moulmein to Prome and across the Arracan Mountains to Tongoup. It is difficult to understand why some Orchids should thrive under such varying climatic differences, whilst, on the other hand, others are circumscribed in their particular localities. However, as a general rule, I think

we may come to the safe conclusion, that all Orchids require a decided season of rest.

The rains commence about the middle or end of April, increasing in intensity until June, from which month to the end of September they are at their maximum, gradually subsiding until the end of October or beginning of November. Of course the monsoon decreases as you recede from the coast line inland.

To those Orchids, therefore, which I have named, I should say the watering should be given as near and in the same proportion as they seasonably received it in their own climate. From November to the end or middle of March, I should say these Orchids should not be forced into growing.

I have in England seen Dendrobium albo-sanguineum flowering and at the same time growing, and in this wise it is figured in the "Botanical Magazine." The specimen I noticed in London under this system of growth had a loose flabby appearance both in flower and pseudo-bulbs. In India albo-sanguineum flowers without a leaf. I have never seen it do otherwise. Saccolabium ampullaceum flowers during the hot season; its leaves become dried, parched, and brown, yet its flowers are of great brilliancy in color, and of good size, having the appearance of a dense stuck-up feather of more than a foot long.

Before proceeding further, I wish it to be understood that I do not profess to express an opinion on the best system of the cultivation of Orchids in England. I have had no practical experience, and consequently am incompetent to do so. My intention in these remarks is to give an account of the natural or instinctive habits of these plants in their own country, leaving the amount of "scorching" or "shrivelling" they can be beneficially subjected to artificially in England to be settled by the judgment and intelligence of experienced cultivators.

In my last letter I concluded with drawing attention to Saccolabium ampullaceum as being a plant capable of bearing a considerable amount of dry heat. In the same category, then, I will also place Vanda teretifolia, for these two plants are found in great profusion together. The latter, having a scandent habit, climbs to the top of large trees; from this I am inclined to infer that its shyness in flowering in England arises from immaturity, or, in other words, from not having regained sufficient age and strength after transportation to England. Although this plant bears the same amount of dry heat as Saccolabium ampullaceum, yet it is found on the Andaman Islands, where the climate is analogous to that of the Straits.

Before dismissing the Orchids found on the plains, I must mention Dendrobium formosum, for I have never observed it grow-

ing at any elevation worthy of notice above the plains, or at any great distance from the sea. On ascending the mountains, more inland, we come across its co-species D. infundibulum, D. eburneum, and D. Jamesianum, which, in my opinion, barely deserve a separate specific name. The favourite habitat for D. formosum is on trees growing on a laterite soil, as Dipterocarpus lævis, and a species of Dillenia. This plant does not seek shady places for growth, in fact, as far as my knowledge goes, few Orchids do, beyond what is given by the trees when in leaf. During the months of February, March, and April, they must be exposed to an atmosphere of 110° Fahr. in the shade. That the fresh-grown pseudo-bulbs are by this heat reduced in size, or "shrivelled" there can be no question, and in some of the mountain Orchids this reduction takes place to such an extent as to render it doubtful whether they are the same plants when first seen at the end of the rains. Cymbidium tigrinum is a good example of this, for when specimens were brought to me at the end of February, I could scarcely identify them as the same plants I had seen growing at the end of November. The pseudo-bulbs had decreased to at least half their dimensions in this short space of time. Saccolabium giganteum and S. guttatum, Vanda Bensoni, Dendrobium Parishii, D. albo-sanguineum, D. Dalhousianum, D. chrysotoxum, Saccolabium ampullaceum, &c., may, as plants found on the plains, be said to bear a difference of temperature, from 46° F. to 110° or 112° F. in the shade during the cold and hot season; and this difference during the month of February would frequently take place in one day.

Enough has, I think, been said about the Orchids found on the plains: I will therefore address myself to those inhabiting the mountain ranges to an altitude of from 6,000 to 7,000 feet above the sea, and to the best of my recollection they may be taken in the following consecutive order of growth, commencing from the plains at an elevation of about 1000 feet:— Dendrobium Bulleriaunm, Thunia Bensoniæ, Dendrobium infundibulum, Cypripedium villosum, Cymbidium tigrinum, Pleione Reichenbachiana, &c.

At the same elevation as Pleione Reichenbachiana, 6,500 feet, Dendrobium infundibulum is found, but its character of growth is somewhat modified, the pseudo-bulbs being compressed or thickened into shorter bulbs, having an almost globose form. At this elevation, then, the thermometer averages in the shade somewhere about 75° in the midday, descending to 40°, or even lower, in the mornings at sun-rise.

The mountain on which these Orchids are found is about 150 miles from Moulmein, and reached by ascending the Houndrow River, which runs in a southerly direction from the Siam territory. This range of mountains will be observed, by the map, to run nearly north and south on the east side of the Sittang and Sa-

ween rivers, forming a vast chain of mountains separating the Shan and other independent States from the British territory on the Moulmein side of British Burmah, forming a vast field for botanical research, the greater part being unknown ground.

The mountain here referred to not being a great distance from the sea becomes subject to a heavy rainfall and moisture from the constant mists from the clouds which frequently envelope it: here then we come to the conclusion that the plants Cymbidium tigrinum, and Pleione Reichenbachiana, will stand a great deal of moisture the greater portion of the year. P. Reichenbachiana was plucked by me in the beginning of December, embedded in moss, from which a goodly supply of water could be squeezed, and the broken or fallen rotten branches of trees were so damp as to render it somewhat difficult for us to kindle our camp fires. On this mountain the dry, or season of rest for the Orchids above named, then, may be taken from December to the middle of March.

I will now close this letter, leaving the Orchids found on and near the Arracan hills to another letter, in which I will conclude the subject, by adding a table showing the several Orchids named in this communication, with their respective localities, the probable amount of rainfall, the elevation and temperature at which they are found.

As I have before mentioned, Vanda Bensoni and Saccolabium giganteum are found in the plains in the drier climate of Prome and its vicinity; but when you commence ascending the Arracan mountains, to which I have already referred, all trace of S. giganteum is lost. The ascent of these mountains begins at a place called Neeounkidouk, about (30) thirty miles from Prome due west; and the highest point reached in crossing through this mountain pass, leading to Tongoup, is about 2,500 to 3,000 feet. At the height of about 2,500 feet, the following Orchids are found:—Dendrobium crystallinum, D. chrysotoxum, Thunia Bensonæ, Pleione Wallichii, Vanda Denisoniana, D. binoculare, and D. crassinod; and at a lower elevation, say 1,500 feet, Dendrobium Bensoniæ and Vanda cœrulescens.

These mountains form, as it were, a barrier to the south-west monsoon, arresting its force to the eastward; consequently, the country around Prome and Thayetmyo (the chief civil and military stations) has a considerably drier climate than that about Rangoon and Moulmein. Thus the rainfall on the Prome, or the east side, is very much less than on the west, which is exposed to the full violence of the south-west monsoon, coming direct from the ocean. Although the rainfall on the east side is greatly diminished in intensity, yet the rain-clouds hang about the tops of these hills, giving them a moist watery vapour, an atmosphere these plants delight in, but without a great deluge of

rain. Observing this, I was led to search these mountains, conceiving I should be well rewarded for my labour, and this turned out to be a correct conclusion.

It is, indeed, strange to see how in ascending a few feet the flora changes, and how some plants are strictly confined to chosen spots, whilst others again are distributed far and wide. How is this to be accounted for? Is it the instinctive sensitiveness of the plants, which causes them to emigrate to suitable habitations, or is the original germ there developed, from the congeniality of certain climatological influences? We hear and read now much about the fertilisation of plants by bees. It has occurred to me, that other insects besides bees are made the vehicle through which fertilisation and hybridisation are carried on. Thus this cross-impregnation or sympathetic assimilation between different plants, together with physical and climatic variations, must naturally tend to modify types. Thus the action of the sun, for instance, must necessarily play a prominent part in these modifications, for its rays, penetrating through different media, as the more rarified air of the mountains and denser atmosphere of the plains, must, it is to be presumed, produce some corresponding chemical effect upon the plants.

However, be this as it may, it is foreign to my present subject; I will, therefore, again refer to the several Orchids found in these parts. The first time I visited these hills was in the beginning of February. The trees had dropped their leaves, the jungle grass was burnt up, even to the elevation of 1,500 feet. The hills were bare. The stems of the leafless trees were charred and scorched, giving the whole country thereabouts a burnt, black, desolate appearance. Here the heat was almost insupportable, and I do think I shall not be exaggerating in stating that the thermometer could not have been less than 120° in the shade at this season; yet this is the spot selected by Vanda cœrulescens and Dendrobium Bensoniæ, and other Orchids. It is not until we get to a higher elevation that we come across Dendrobium crassinode, D. crystallinum, Vanda Denisoniana, D. binoculare, D. Farmeri (yellow variety), &c. The three last named plants prefer more shady places to D. crystallinum and D. crassinode. For more detailed particulars, the following table may be referred to:

Names.	Approximate elevation in feet.	Average temperature.	Probable rainfall in inches.	Locality and Remarks.
Dendrobidæ.		Deg. F.		
D. barbatulum	...	80 to 83	120 to 200	Plains of Moulmein and Rangoon; on trees; generally of small size.
„ Rensonæ	1500 to 2000	80	90	Arracan hills, about half way up, on exposed ridges; in addition to rain, great moisture; trees.
„ binoculare	2000 to 2500	75	90	Ditto; shady places.
„ Bullerianum	1000 to 1500	75 to 80	120 to 200	Mountains near Moulmein, &c.; trees.
„ crassinode	2000 to 2500	75	90	Arracan and Siam mountains; on large trees; scarce; moisture considerable; thermometer falling to 46 in cold seasons.
„ cretaceum	...	80 to 83	200 to 250	Wide distribution on plains of Burmah.
„ chrysotoxum	2500	75 to 83	90 to 200	Plains and mountains; wide distribution. This plant is hardy, thriving in dry and moist climates; when found on mountains, pseudo-bulbs compressed globose.
„ christallinum	2500	75	90	Arracan mountains; small trees; exposed ridges.
„ Dalhousianum	...	80 to 83	90 to 200	Plains; wide distribution.
„ Farmeri, white ...	...	80 to 83	200 to 250	Plains and low hills near Moulmein.
„ „ yellow ...	2500	75	90	Arracan mountains; large trees and shady places.
„ fimbriatum	...	80 to 83	90 to 250	Plains and mountains in Burmah.
„ formosum	...	80 to 83	150 to 250	Plains, Rangoon, Moulmein; near the coast in abundance.
„ infundibulum	1600 to 6500	70 to 80	200 to 250	Mountains near Moulmein.
„ Jamesianum	1500	80	90 to 100	Arracan range, near Prome.
„ muschatum	...	80 to 83	150 to 250	Plains in Burmah; plentiful.
„ nodatum	...	70 to 80	100 to 250	Plains and mountains; hardy.
„ Pierardi	...	80 to 83	150 to 250	Common; plains and hills.
Bletidæ.				
Phaius albus	...	80 to 83	150 to 250	Widely distributed on Burmah plains.

Thunia Bensonæ	1000 to 2000	80	150 to 250	Arracan and Moulmein mountains; there is a yellow and red variety.
Vandeæ.				
Aerides Lobbii	...	80 to 83	150 to 250	Plains, Moulmein; plentiful.
„ roseum	...	80 to 83	150 to 250	Plains, Rangoon and Moulmein; local.
„ odoratum	...	80 to 83	150 to 250	Ditto; very common.
Saccolabium ampullaceum.	...	80 to 83	150 to 250	About 70 miles north of Rangoon.
„ Blumei	...	80 to 83	150 to 250	Very common, plains, Burmah.
„ giganteum	...	80 to 83	90 to 150	Plains near Prome, Thayetmyo, and Tonghoo.
„ guttatum	...	80 to 83	90 to 150	Ditto.
Vanda Bensoni	...	80 to 83	90 to 100	Ditto.
„ cœrulescens	1000 to 1500	80 to 83	90 to 100	Arracan mountains; deciduous trees.
„ Denisoniana	2500	70	90	Ditto; shady places; trees.
„ gigantea	...	80 to 83	150 to 250	Jungles, Moulmein and Rangoon; plentiful.
Cypripedieæ.				
C. concolor	...	80 to 83	200 to 250	Moulmein, on rocks (lime stone).
„ villosum	2000	70 to 75	200 to 250	Moulmein and Tonghoo mountains.
Cælogynidæ.				
Pleione Reichenbachiana...	6500 to 7000	65 to 70	200 to 250	Alpine; near Moulmein.
„ Wallichii	2500 to 3000	70 to 75	100	Arracan mountains.
Phalænopsids.				
P. Lowii	...	80 to 83	200 to 250	Plains near Moulmein: rocks.
„ Parishii	...	80 to 83	200 to 250	Plains, jungle trees; Moulmein and Rangoon; trees.
Brassidæ.				
Cymbidium tigrinum ...	6500 to 7000	65 to 70	200 to 250	Moulmein mountains; trees.

Besides the above, there are various others, which I have not considered worthy of notice. I have given the localities in which I have myself found the Orchids. The rainfall and temperature is, of course, only taken approximately.—R. BENSON.—*Gardener's Chronicle for* 1870.

Extracts from the Annual Report on the Management of the Government Experimental Farm at Sydapet, Madras, for the year ending 31st March 1870.

It was so excessively dry during the months of April, May, and June, that very little field-work could be done, and the sheep stock suffered greatly from the extreme heat. On sixteen days in the latter month, the maximum thermometer recorded above 100 degrees, and the thermometer exposed in the sun, frequently registered 140 degrees.

The showers which fell during July and August enabled us to commence field-work again; and we took advantage of the opportunity to plough and clean the land intended to be cropped during the cold season. September and October were very favorable months for preparing the land for sowing, and no weather could be more suitable for the young seeds, than that experienced in November, rain falling on twenty days during the month. In the next month rain fell only on nine days; and in January only on three days. About the middle of this month, a severe storm of rain and wind broke over the district, and did a considerable amount of damage to maize, cholum, and other tall growing crops; the rain, however, was beneficial to the pastures. Rain fell only on one day in February, and there was no rain in March. The amount of rain that fell during the monsoon was considerably below the usual quantity, and very little water was stored for irrigation. The weather experienced was, however, very favourable for growing crops, the falls of rain were so regular and gentle.

Manures.

A large quantity of aquatic weeds have been collected off the river Adyar. I have found these weeds particularly valuable, not so much for their manurial value, as for the property they possess of starting fermentation amongst material which it would otherwise be very difficult to decompose. Not only by their own decomposition do they yield moisture; but, in virtue of their hygroscopic qualities they attract a good deal of moisture. In this dry climate it is a difficult matter to decompose mango leaves, and cumboo, or cholum stalks.

In digging a drain we came upon a seam of rich alluvial deposit, it is about three feet thick and is situated about two feet from the surface of the ground, and can be raised at about one anna a load. We have already used, with great advantage, a considerable quantity of similar soil, obtained from tanks and the river bed, as a base for our composite manure.

With this soil we mix burnt earth, obtained at an old brick-yard on the Farm, mango leaves, fold-yard manure, the aquatic weeds already referred to, bazaar refuse, &c., jungle plants, such as the mudder plants, the wild indigo, and croton oil plants, and pour the blood and slaughter-house refuse through the whole. The amount of fermentation is regulated according to the period when the manure is required. If it is for immediate use, the heap is thrown up lightly and fermentation takes place rapidly. If it is for use at some distant date, then we cause the carts to pass over the heap and consolidate it as much as possible. We also regulate the fermentation according to the nature of the soil to be manured. Thus if the land is very light and sandy, we have the manure thoroughly decomposed before applying it, if on the other hand, the land is stiff and adhesive,—qualities, a very small area of our land possesses—then we apply the manure in a half fermented state.

We have given up the cart-stand to a tenant; though a fair supply of manure was obtained from it at certain seasons, still, it scarcely paid for attendance, besides, the manure was very inferior, it chiefly consisted of sweepings, and contained a considerable quantity of weed seeds.

A large amount of first rate manure was made on the Farm by the fattening stock. The greater portion was made in the loose boxes, where it was uninjured either by the sun or the rains. I have not yet had an opportunity in this country of making a careful experiment, to determine the relative value of a manure as usually made, and as made in loose boxes, I am however, prefectly satisfied that the manure is very much superior to any manure I have yet seen in this country, and that loose box feeding, which has done so much for the agriculture of England, can do much for the agriculture of India.

Though we cannot hope, in the present day, to see box feeding adopted in this country, for the same object as in Europe; still, there can be no reason why working and young cattle should not be kept in loose boxes at night. If we are to grow cotton, maize, &c., we must have manure, and there is no better or more economical way of making it than under the loose box system. On sanitary grounds alone, the system is worth general adoption. At first sight it may appear objectionable to keep the animals for three or four months in the boxes, without removing the manure; however, I have become acquainted with no bad results that arise from the practice; indeed, on the contrary, though we have fed a considerable number of cattle since we commenced the system, none of the animals have had a single day's illness, and in several instances, the manure was not removed for upwards of three months, while it had accumulated to nearly two feet in depth. Of course the excrements are not allowed to collect on the surface, the usual plan is for the cattl

feeder to enter the boxes three or four times a day and with a fork throw up the bedding. No smell whatever is perceptible, and there is nothing that the most fastidious person could object to, indeed, in this respect it is much cleaner than the usual system, which allows the solid and liquid excrements to lay and decompose upon the surface of the ground. In the loose box system the products of decomposition are absorbed by the litter, and the straw, in virtue of its capillary action, takes up the liquid matter.

A number of experiments were made to determine the feeding values of the different fodders grown on the Farm. Amongst others the following:

Four bullocks, aged from four to five years, were put into the loose boxes in the beginning of February last. They all received the same amount of cake and corn, and each animal had as much of the fodder as it could consume; they were weighed at the end of every ten days with the following results:

	Bullocks fed on grass	Bullocks fed on cholum fodder.	Bullocks fed on guinea grass.	Bullocks fed on gram fodder.
1st Weighing	384	343	287	360
2nd do.	406	310	304	375
3rd do.	415	335	310	375
4th do.	423	359	315	388
5th do.	431	367	329	396
6th do.	430	383	331	403

Much to my surprise, the guinea grass produced the largest results, thus the animal consuming this fodder, yielded an increase of 15·33 pound for each one hundred pound of its live weight. The results from the other three fodders were very similar, thus, for each one hundred pound of the animals live weight, grass gave an increase of 11·97 pound; cholum fodder, 11·66 pound; and gram fodder, 11·94 pound. I believe the result, obtained from the guinea grass, is larger than will be obtained under ordinary circumstances. In repeating the experiments on other animals, in no single instance has guinea grass given such returns. These results will be better appreciated when considered along with the cost of producing these fodders; thus, on this Farm, the cost of producing one ton of each of the fodder is:

Grass	Rupees	10
Gram fodder...	"	3
Cholum fodder	"	$2\frac{1}{2}$
Guinea grass	"	7

or their relative cost will stand thus:—grass 100, guinea grass 70, gram fodder 30, and cholum fodder 20·50.

Maize.

A quantity of maize was obtained from America early in September; however, it had heated to such an extent on the voyage as to be prefectly useless for seed. One of the barrels contained about 5 per cent. of vital grain; but in the majority of the barrels there was only 2 or 3 per cent. of vital seed, and in two instances not even 1 per cent. One or two of the best lots were steeped, and the seeds that germinated were picked out and planted; however, very few good plants were obtained, and the few that did grow, produced no good results.

A supply of yellow maize was obtained from Bangalore; the grain was very small, though sound and fresh. On the 26th October, 18 pounds of it was sown in field No. 18, after a crop of gram fodder. It grew well and rapidly; however, the plants never exceeded 3 feet in height, and none of the cobs were over 4 inches in length. The crop was reaped on the 6th of January, and after drying was found to yield 766½ pound of grain and 1½ ton of straw. We selected a few of the best cobs for sowing next season. If we can enlarge the cobs and seed, the variety will become a valuable one for the rapidity with which it grows and matures its seed.

The yellow maize, obtained from Sydney, produced most satisfactory results. The seed arrived in fine condition; and, when sown, contained above 80 per cent. of vital grain. The crop grew very luxuriantly; when the plants were full grown, they were quite 9 feet high. The cobs were large and well formed. The results were such as to leave no doubt of the great value of this variety of maize for general cultivation on the plains. Upwards of 4,000 pounds of the seed grown upon the farm, will be distributed over the Presidency amongst cultivators. If only ordinary care is taken with the produce, there should, next season, be a large amount of seed in the country. The financial results of the experiments were equally satisfactory. In the appendix I have recorded all details connected with this experiment.

Yellow Cholum.

A considerable area of land was sown with yellow cholum for fodder. Indeed, during the past year, the large stock of cattle on the farm were almost entirely fed on cholum fodder. I find that a *thorough change of seed* is essential to the successful cultivation of yellow cholum, during a course of years. The plant is liable to be attacked by rust and blighted, if the seed is not frequently changed. Cultivators of sandy or gravelly soils should obtain their seed from alluvial, or clay districts; and cultivators on the latter soils from districts where sands or gravelly soils predominate. Under "Cattle" I have recorded the experiment made to determine its feeding value; and, in a special

report which appears in the appendix, I have detailed all the results attending its cultivation.

White Cholum.

We have not experimented so largely with this crop; however, as far as our experiments have gone, the results have not been so satisfactory as those attending the cultivation of 'yellow cholum.' A piece of land about $1\frac{1}{4}$ acre in extent was sown, on the 9th of September, with white cholum. The crop grew very irregularly, and was so blighted when in flower that it was not considered wise to seed it; it was accordingly cut down, and yielded 1 ton, 12 cwt., 15 lbs. of dry fodder; another plot about one-fifth of an acre in extent was sown in the last week in December. This crop was also blighted and had to be cut for fodder, it yielded 10 cwt., 35 lbs. of dry straw. In both instances the blight was so severe it was not considered advisable to leave the roots for a second crop. The seed was certainly not good, little more than 50 per cent., was vital; however, I attribute the blight to unseasonable sowing. This variety of cholum evidently requires a higher temperature than the yellow variety. The crops now growing are not only not blighted, but are as healthy as could be desired. I am now experimenting with two or three plots of white cholum in order to determine whether it will bear cutting over as often, and yield so much fodder as yellow cholum.

Horse Gram.

A considerable area of ground was cultivated under horse gram for green fodder. In several instances it was cultivated as a "catch crop" immediately before, or just after, the regular crop.' The results were highly satisfactory; they have been drawn up in the form of a special report, a copy of which appears in the appendix. [See *ante* page 41.]

Bengal Gram.

A small plot of grouud was sown with this variety of gram; but the result was not such as to induce me to extend its cultivation here. The horse gram grown under similar conditions gave far superior returns.

Carolina Paddy.

The cultivation of this paddy has been most successfully carried on at this farm, the results have been highly satisfactory. Our experiments have proved that it requires no special culture, and that the *best Native system of growing paddy* is the *best system* of *cultivating Carolina paddy.* I find that good results can be obtained either by sowing the seed at once in the paddy bed, or by sowing it in a seed bed and afterwards transplanting the plants into the paddy bed, and that either procedure may be

justified by the peculiar circumstances of the ryot. The best result was on plot No. 3; this plot contains 225 square yards. It was planted on the 8th of October with the plants produced by half a measure of seed. The crop was reaped on the 8th of February, and, after drying, was found to yield 336 pounds of straw and 70 measures, or 160 pounds of paddy. This result would be 7,183 pounds of straw and 1,505 measures, or 3,441 pounds of seed per acre. Assuming that twenty Madras measures are equal to an English bushel, the yield will be about seventy-five bushels per acre. In the report in the appendix, I have detailed our experiences in the cultivation of Carolina paddy during the past year.

Italian rye grass.

In the beginning of September, a few pounds of seed of this variety of grass was sown in the experimental bed. It germinated freely; however, the sun killed the young plants as they appeared above ground. By covering the earth with leaves we were able to get a good crop of plants, and the grass continued to grow until the beginning of February, when the plants died away as the heat of the sun became greater, and by the end of March they had all disappeared. The grass is not suited for this climate. It is possible that during a course of years, it might be acclimatised. However, until we have proved that the indigenous grasses of this country are useless, it would be a waste of time to attempt acclimatising such tender grasses.

Lucerne.

Under irrigation, this plant produces a large quantity of valuable fodder. We sowed a few pounds of English seed in September last, it grew satisfactorily and has yielded three cuttings of excellent fodder. It does not appear to be injured by the heat of the sun, though the thermometer, exposed in the sun's rays, has during the past month frequently registered 135 degrees, still the crop appears vigorous and healthy.

Beet-root.

A small supply of German beet seed was obtained from England, and a portion was sown in September, the ground being occasionally watered. The plants grew satisfactorily, however; insects were very troublesome, and many good plants were destroyed by them. The land occupied measured 36 square yards, and 140 pounds of root was obtained from it. Many of these roots weighed from 3½ to 4 pounds. The cattle and pigs appeared very fond of them, I do not think the crop will pay for cultivation in this district, besides it will not stand in the hot season, many roots left in the ground, to produce seed, have during the last few weeks been killed by the heat of the sun, and those that are still alive

are so parched and dried up, that there is not the least hope of their surviving the hot season.

Mangold wurzel.

A few pounds of mangold seed was obtained from England, along with the beet-seed. It was sown in September, and germinated, and grew vigorously; when about a month old the young plants were transplanted from the seed bed to the field. They were occasionally watered, and throve spendidly. However, when about half grown, they were suddenly attacked by caterpillars, and suffered great damage indeed, I then almost despaired of rearing a single plant. We dusted the plants, when wet with dew, thoroughly with lime powder, and ashes, with a sprinkling of guano, and had the gratification of seeing that the insects and caterpillars had entirely disappeared after two or three dressings. The plants had received a severe check; however, they put out fresh leaves and soon recovered from the effects of the caterpillars. The crop was gathered a few weeks ago, a plot of 36 square yards yielded 294 pounds of roots, some of which weighed eight pounds, while the average weight would be about four pounds. The roots were badly formed, though they were good tasted, and sound. I left some in the ground to produce seed; but, like the beet, they were killed by the heat of the sun.

Ragi.

On the 31st May, a plot containing 3,420 square yards was planted with ragi. The cost per acre of cultivation, &c., is detailed below:—

	Rs.	As.	P.
Ploughing	1	0	0
Harrowing	0	2	0
Ridging	0	8	0
Manure	2	8	0
Spreading manure ...	0	4	0
Ragi plants	1	0	0
Planting	1	0	0
Watering ten times ...	7	0	0
Hoeing	1	0	0
Cutting off head of grain	1	0	0
Cutting down straw ...	0	6	0
Threshing and winnowing	1	4	0
	17	0	0

The crop was reaped on the 25th of August and produced 242½ measure or 665 pounds of grain; and 1 ton, 6 cwt., 8½ lbs. of straw. Per acre the yield was 344 measures or 941 pounds of grain and 1 ton, 17 cwt., 53 lbs. of straw; valuing the grain at 16 measures

per Rupee, and the straw at 3 Rupees per ton, the total income was Rupees 27, Annas 2; against Rupees 17 expense; leaving a profit of Rupees 10, Annas 2 per acre.

Guinea Grass.

A small field, about 2½ acres in extent, was planted with guinea grass.

The cost per acre of planting, &c., was as follows:

	Rs.	As.	P.
Ploughing	1	0	0
Harrowing	0	2	0
Ridging	0	8	0
10 Tons of manure	10	0	0
Spreading manure	0	8	0
Splitting ridges	0	8	0
Watering	1	4	0
Plants	1	8	0
Planting	3	12	0
	19	2	0

The manure and plants may last for two years, at the end of that time fresh manure will be needed and the plants will require to be re-planted.

During the two years at least twenty-four waterings will be needed to keep the plants growing, these waterings will cost Rupees 24; and between each cutting, a hand hoeing, and two double bullock hoeings, will be required, the cost of these operations, assuming that five cuttings per annum will be obtained, with the cost of cutting the crop, will amount to Rupees 59. Including the cost of planting Rupees 19, Annas 2, the total cost will be Rupees 78, Annas 2. From the results of my experiments during the past year, I do not think the total yield of the ten cuttings will exceed 11 tons of fodder. One ton of the fodder thus costing Rupees 7.

The following experiment was made on the guinea grass in No. 13 field.

——	1st Cutting.	2nd Cutting.	3rd Cutting.
	Pounds.	Pounds	Pounds.
Plot 1, area 2,000 square yards applied 2 cwt. of bone-dust	1,960	1,286	1,428
Plot 2, area 2,000 square yards applied 2 cwt. of guano	2,408	1,510	1,306
Plot 3, area 2,000 square yards, no artificial manure to this plot	1,512	1,288	1,232

Implements, &c.

I have already recorded in a separate report, a copy of which appears in the Appendix, a number of experiments made with our various water-lifts, pumps, &c., and a few of the machines in regular use upon the farm.

Winnowing machines are regularly employed. The coolies understand them thoroughly, and appreciate them highly. Native visitors take much interest in these machines; but consider them too costly.

The threshing machines have very seldom been employed, we have grown so little grain that they could thresh. It would not pay to set them up *for a few hours work*, especially as the bullocks are to train each time they are worked. These machines are required so seldom, and the intervals between each time are so long, that the bullocks never get thoroughly trained, as there is no other employment upon the farm which requires four of them to work together. However, as the area of the farm is increased we will gradually find employment for these machines.

Ransome and Sims', and Howard ploughs have been in constant use whenever weather permitted. Both large and small ploughs have been employed, the former we find useful, when the ground is so dry and hard that the light plough cannot penetrate it. Both cattle and coolies work them well. The coolies readily learn the use of the plough, some are very good ploughmen, and are as proud of their skill as any English ploughman; indeed, I have seen some of them turn as straight and regular a furrow as I ever witnessed in any of our champion ploughing matches. A remarkable change has taken place in the observations of the ryots who come to see our operations. Twelve months ago, one of their greatest objections to our ploughs, was, that they ploughed too deep; now, after we have had a very dry season, and they have seen for themselves how our crops throve and looked fresh and healthy; while theirs were parched and dried up, they no longer make this objection. The chief objection they now advance against our ploughs is their great cost in comparison with native ploughs. The force of this objection will be better appreciated when I state that twenty or twenty-five native ploughs can be purchased for the price asked for one of our English ploughs. Until a plough is offered to the ryots at a fifth, or at the highest, a fourth of the price we now ask for our plough, there is little probability of their use becoming more general. I am now giving attention to the matter, and hope, before I write another annual report, I shall have made some progress towards overcoming this difficulty. A very good combined plough was obtained from the Roorkee work-shops. It is cheap and strong. Including carriage it costs only about Rupees 20. It is a swing plough; however we had to convert

it into a wheel plough as it was so difficult to hold, and ploughed so irregularly: a few other details required altering; thus, the stills were too high for our coolies; and the method of attaching the draught chain was defective. For ordinary use we use the small ploughs made by Messrs. Howard and Ransomes and Sims. A Scotch Double Mould Board plough has done a great deal of work during the past season. It had been laid aside as useless; however, by putting it on wheels and cutting it down to little more than half the weight, we have made it into a useful plough.

The iron prong, and chain harrows have been in constant use. The chain harrows we have found of great value on our light sandy soil for collecting weeds, covering seeds, and consolidating the soil. The iron harrows are rather heavy 'seed-harrows,' and are not so useful for general work as 'drag harrows,' besides they are much too costly. I think that by combining wood and iron, a cheaper and better harrow for general use could be made.

The reaping machine has been occasionally employed for cutting cholum. The coolies understand how to work it, and can safely be entrusted with it by themselves.

Horse hoes and cultivators were fully employed during the last season. The land being in such a foul state with weeds, most of the crops were grown in drills, and the space between the drills constantly stirred by the bullock hoes or cultivators. Indeed there is not a more useful implement to the Indian cultivator, especially when irrigation between the rows of standing crops is adopted. After watering, the soil usually becomes caked on the surface, and if water is applied when in that state it either runs off, or passes away by evaporation. When the cultivator is passed between the drills, shortly after the surface of the soil has begun to cake, it pulverises and opens up the soil, enabling it to absorb the dews and to appropriate the water when next it is applied.

The steaming apparatus manufactured by Messrs. Richmond and Chandler is in regular use for steaming the food of the working cattle. An authority, who had made some enquiries into the subject, states that in comparison with the usual method of boiling gram in this district, at the present price of fuel, the apparatus would effect a saving of Rupees 84 per annum.

Carts and wheel-barrows are regularly used. The carts are drawn by a pair of bullocks; they are built to carry about 8 cwt. of fold yard manure or with frames, about half a ton of hay. Though the carts have fixed bodies, yet at a recent competition, one carter, with a cooly to assist in filling the carts, removed five loads of manure to a distance of 1,484 feet in 105 minutes; his bullocks never travelling beyond a walking pace. In this competition, dung forks were used for filling the carts, though the competitors might have used mamoties and baskets, the usual

country way of filling manure, had they desired. Wheel-barrows are in constant use, we never use baskets, excepting in places where we cannot work barrows. Whatever may be the experience in other districts, I certainly have had no difficulty in getting our coolies to use wheel-barrows. Indeed, on several occasions I have had to use my authority to prevent their using the wheel-barrows on water channel banks and over irrigated ground, where a basket would certainly have been more useful. Recently, a competition was held to test our coolies' abilities in using the wheel-barrows. Small prizes were offered and about a dozen sets of men entered. The ground was divided in plots, 9 feet and 6 feet wide, and each plot was to be excavated 1 foot deep; thus removing 2 cubic yards. The men entered in sets of two, one wheeled and assisted in filling the barrows while the other excavated and also assisted in filling. The earth was wheeled a distance of 51 feet. A very keen competition took place, indeed it was a regular race; the following are the results:

1st set, completed their work in 35 minutes.
2nd set, completed their work in $37\frac{1}{2}$ minutes.
3rd set, completed their work in 39 minutes.
4th set, completed their work in 42 minutes.

The soil was so hard it had to be loosened with a pick before it could be dug out. I need scarcely remark that this labor was far beyond their usual exertions; and was too excessive to be continued for any length of time; however, the results, show what they can do under certain circumstances. Considering their light weight, our coolies handle the wheel-barrow with considerable skill.

Grass knives, picks, mattocks, manure forks, hay forks, shovels, iron and wood rakes, hedge knives, &c., are in regular use upon the Farm. Many of the tools are handled very skilfully by our coolies. By the use of the improved grass knife, we have reduced the cost of cutting grass, &c., to one half. An area of grass land, for which we usually paid Rupees 10 for cutting with country knives, I can now cut with the new knives for Rupees $4\frac{1}{2}$; indeed the contractor offered to cut it for Rupees 5, if we would lend him our knives. The hedge knives are also very useful; at the last competition, 3 men cut in one hour each:

1st...	...	...168 feet
2nd	...	...165 do.
3rd	...	...150 do.

of corkapilly hedge, both sides. The work certainly was not neatly performed, though well enough for ordinary Farm fences. For filling manure into carts we now generally use the ordinary manure fork. I experienced some difficulty at first, in getting our coolies to work in the upright position required for the proper use of this fork. Some of them now use them admirably, and appear

to appreciate their value. On introducing a new tool, though I insist upon their using it, if satisfied, in my own mind, that its use will be advantageous to agriculture, I always endeavour to convince them of its superiority over the tools in ordinary use; and try to effect my object through their inclination, rather than by my authority.

We now make upon the Farm, hedge knives, grass knives, hand hoes, shovels, axes, plough shares coulters, &c., for our own use, or for sale, as patterns, to those who prefer to have them made by their local native blacksmiths.

Report of the Superintendent of the Government Farm on the cultivation of the Yellow Cholum.

This is a beautiful grass, resembling in appearance Indian Corn. It bears a small yellow seed; which, when crushed, makes a good auxiliary food for cattle or sheep. It grows on all kinds of cultivated soil, but best on those that are *thoroughly* cultivated and well manured. Indeed, few crops will pay better for *high cultivation.* This valuable plant has attracted a great deal of attention during the last few years, and has been highly recommended as a fodder-crop. It is best suited for cultivation in countries where the temperature seldom falls below 60 degrees. It will certainly grow in much colder climates, but scarcely pays expenses. A few years ago the cultivation of this crop was attempted in England, and, amongst other places, on the Experimental Farm attached to the Royal Agricultural College: the yield of green food was insignificant, and its further cultivation was not deemed advisable. The experiment was, however, valuable in affording Dr. Voelcker an opportunity of analysing the crop during different stages of its growth. He found that the half-grown plant contained above two-and-a-half per cent. of flesh-forming matters, and about eleven per cent. of fat, as heat-producing matters. As the Turnip is the sheet anchor of the stock-feeder at Home, we place its analysis alongside Dr. Voelcker's analysis of Yellow Cholum. A glance at these analysis will suffice to show the great value of Yellow Cholum fodder as food for Farm Stock:

	Yellow Cholum.	*Turnip.*
	Per cent.	Per cent.
Water	85·17	90·43
Flesh-forming matters	2·55	1·04
Fat or heat-producing matters ...	11·14	7·89
Inorganic matters	1·14	·64
	100·00	100·00

Dr. Voelcker found that in the half-grown plant there was little or no sugar; but when the plant was three-quarter grown, there

was as much as 5·85 per cent. of sugar in the lower part of the plant. We have no analysis of Indian-grown plants; however, it may safely be inferred that, if such a large amount of sugar was present in plants grown in a climate so ill-suited for the production of sugar as that of England, a very much larger quantity will be found in Indian-grown plants.

2. On the Government Experimental Farm at Madras, during the past twelve months, this crop has largely been grown, and, generally, with very satisfactory results. We propose briefly recording some of the facts ascertained and some of the conclusions formed regarding the culture of this crop for fodder. These conclusions are not founded on a single experiment, but on a large number, occupying, in the aggregate, nearly fifty acres of land. The season was certainly very unpropitious for cultivation of any sort, more especially for cultivation conducted on a soil so extremely sandy and porous as that constituting the Government Farm. The following is an average analysis of the soils upon which these crops were grown:

	Per cent.
Alumina	3·24
Oxide of iron	1·35
Phosphate of lime	·12
Carbonate of lime	·31
Sulphate of lime	trace
Carbonate of magnesia...	trace
Chlorides	·90
Water	2·09
Organic matter	2·12
Sand	89·87
	100·00

3. We now proceed to record the results obtained from two or three of our experimental plots.

Experiments.

In December 1868 we sowed a plot containing 2,420 square-yards, or half an acre of land, with Yellow Cholum, and have, in the eleven months which have since elapsed, obtained five cuttings, yielding in all 10 tons, 5 cwt., 56 lbs., or 23 tons, 3 cwt., 14 lbs. per acre per annum.

Another plot of a similar size was sown in April last, and during the seven months it has been growing, has yielded three cuttings, weighing 5 tons, 15 cwt., and 10 lbs. At the present time there is probably about one-third of a crop in the field, making a total of 6 tons, 7 cwt., 20 lbs., or a gross produce of 21 tons, 16 cwt., and 8 lbs. per acre per annum.

Both of these crops were occasionally watered. The first crop was irrigated weekly during the first three months of the experiment, and about twice a-month afterwards. The other about twice a week during the first four or five months, and not oftener than once a-month during the remainder of the time. At each time of watering, the water was applied at the rate of about 30,000 gallons per acre. Had a sufficient quantity of water been available, much better results would have been obtained. During the last few months the ground was frequently in such a dry parched condition—the result of the excessively dry season—that for weeks together the bulk of the crop was scarcely increased. The first plot received no manure, except about 4 cwt. of wood-ashes. To the other plot, which had just borne a crop of maize, about 5 tons of farm-yard manure was applied.

Another plot of ground, measuring $2\frac{1}{10}$ acres, was sown during the last week of June. No water was applied to this crop; it entirely depended on the rains and dews for its supply of moisture. Two cuttings have been obtained, weighing 8 tons, 19 cwt., and there is still about 20 cwt. in the field, making a total return of 9 tons, 19 cwt., during the five months the crop has been growing, or, presuming that the rains and dews will suffice for the wants of the crop for three months longer, an average yearly return of 7 tons, 12 cwt. per acre. Manure was applied to this crop at the rate of 8 tons per acre.

These are not exceptional results: the crops now growing on the farm will probably yield larger returns than any we have recorded.

Soils.

Yellow Cholum can be grown on all kinds of cultivated land, provided the soil is in a good condition, and is fairly manured and cultivated. If the soil is naturally rich in plant-food, or is made so by artificial means, the larger will be the returns.

Cultivation.

It is advisable to plough the land *well*: the number of times and the depth will depend on its condition, and must be left to the intelligence of the cultivator. Our practice, when the soil contains only a few weeds, is to plough to the depth of 5 or 6 inches, and cross with a broad-share cultivator at right angles the line of the plough; collect the weeds; broad-cast about 6 or 7 tons of foldyard-manure over the surface; plough in the manure, driving the plough across the lines of the first ploughing; harrow the surface, to make it level; and then sow the seeds in lines about twenty-six inches apart, finishing the work by passing the chain-harrows over the surface. If intended for irrigation, we proceed as follows: plough 5 or 6 inches deep; cross with cultivator to level the furrows; collect weeds; drill

the soil in ridges about 28 inches wide, either with a single or a double mould-beard plough; spread the manure in the lines between the ridges; split the ridges with the plough, throwing a furrow on the manure on either side the track of the plough, forming the open furrow, down which the water passes while the crop is being irrigated. The land is thus left in *ridge and furrow* as is the custom in England, for the cultivation of Turnips or Mangolds. The seed is sown on the top of the ridge over the manure. Whether sown on the level surface or on the ridge, from 26 or 30 pounds of seed per acre will suffice. During the growth of the crop the ground between the lines of plants should be kept as free from weeds as possible, either by frequent use of the hand-hoe or bullock-hoe. If the land is tolerably free from weeds two bullock-hoeings and one hand-hoeing will suffice between each cutting.

Water.

Irrigation produces at least three times the weight of fodder obtained under dry cultivation. In the former case, the crop will continue to grow eleven or twelve months, and give six or eight cuttings; while in the latter only seven or eight months, and yield three or four cuttings. Water should be applied once or twice a-week, according to the state of the weather and condition of the soil; if water can be obtained at a reasonable cost, we would apply it twice a-week for three weeks after sowing and after cutting, and once a-week afterwards. Dressings of from twelve to fifteen thousand gallons per acre will be sufficient for each application. However, as we have already stated, much depends upon the porosity of the soil and the humidity of the atmosphere.

Manure.

There is nothing like a good application of foldyard-manure for producing a *good* crop, though, in the absence of this, poudrette, tank-mud, (which has been previously thoroughly exposed to the air,) burnt earth, the refuse of brickyards, wood-ashes, leaves of various plants and trees, aquatic weed (either fresh water or marine,) bazaar-refuse, etc., may usefully be applied.

Harvesting, &c.

We would advise that cutting should commence when the plant is about two-thirds grown. We use a small curved knife for the purpose; with it the coolies can easily cut down an acre in a day. The fodder is best used in the green state after dew or any adhering moisture has been removed by exposure for an hour or two in the sun. Horses, cattle, sheep, and pigs eat it readily. It may be cut, dried, and stacked for consumption during hot weather when fodder is scarce. When dried in this manner, it is best given to the stock-chaffer.

Cost of Production.

Under dry cultivation, the cost per acre is as follows:

	Rs.	As.	P.
Ploughing	1	0	0
Cultivating	0	6	0
Collecting weeds...	0	12	0
Six tons of manure	6	0	0
Spreading manure	0	3	0
Ploughing	0	12	0
Harrowing	0	2	0
Seeds	1	0	0
Sowing	0	12	0
Chain-harrowing...	0	2	0
After Cultivation.			
5 Hand-hoeings	5	0	0
8 Bullock-hoeings .. .	5	0	0
4 Cuttings	2	0	0
	23	1	0

With a gross yield of 8 tons per acre, the cost of the fodder will be Rupees 2, Annas 14, and Pie 1 per ton.

When irrigated, the cost per acre will be as below:

	Rs.	As.	P.
Ploughing	1	0	0
Cultivating	0	6	0
Collecting weeds...	0	12	0
Ridging soil	0	8	0
Six tons of manure . ..	6	0	0
Spreading manure	0	3	0
Splitting ridges	0	8	0
Seed	1	0	0
Sowing...	0	9	0
After Culture.			
8 Hand-hoeings	8	0	0
12 Bullock-hoeings	6	0	0
6 Cuttings	3	0	0
Raising 500,000 gallons of water a height of 18 feet, and distributing the water, etc.	20	0	0
	47	14	0

With a gross return of 24 tons of fodder, the cost per ton will be Rupee 1, Annas 15, and Pies 11.

Summary.

1. Yellow Cholum is suited for cultivation on all cultivated soils and in all climates where the temperature does not often fall below 60 degrees.

2. Weight for weight, it contains a larger proportion of nutritious matters than Turnips.

3. It is best cut for fodder when two-thirds grown.

4. When irrigated, 24 tons per acre per annum can readily be grown.

5. As a dry crop, it will grow for seven or eight months, yielding about four cuttings, weighing 8 tons.

6. When cut in the green state, it is readily eaten by horses, cattle, sheep, and pigs.

7. Under dry cultivation, one ton of the green fodder can be grown for Rupees 2, Annas 14, and Pie 1.

8. When irrigated, one ton of the green fodder can be grown for Rupee 1, Annas 15, and Pice 11.

Experiments with Queensland Maize under Dry Cultivation.

On the 9th of October, 1869, 240 pounds of yellow maize was received from Sydney: it was a good fresh sample of the "one-hundred-and-twenty-day variety," and contained 82 per cent. of vital seed, dried at 212 degrees Fahrenheit. Seventy-eight grains weighed an ounce. It was distributed as follows:

	Pounds.
To collectors	68
Sown in vacancies in general crop	15
Do. for experimental purposes	157

2. *Soils.*—The soils of the different experimental plots are very similar in composition. As they have already been described in former Reports, I would only remark that, they are very poor and hungry, and contain on the average nearly 90 per cent. of sand.

3. *Preparation of the seed.*—To prevent squirrels, rats, crows, etc., destroying the seed, it was all tarred. The process is as follows: Take one-and-a-half pints (about half a Madras measure) of hot water, and add about one-twelfth of a pint (about one-fourth of an ollock) of tar, stir well together. After allowing the solution to cool, pour it through about twenty measures of maize, mix thoroughly, until the seed assumes a dark mahogany colour; it must then be dusted with sand, saw-dust, or dry-earth, to prevent the seeds adhering together, and will be ready for sowing. In America it is usual to steep the seed for ten or twelve hours before it undergoes this process; but I have not found steeping to

answer here, excepting during dull or showery weather, the dry condition of the soil and the great heat of the sun being injurious to the vitality of the seed when in a softened condition. Whether this arises from the rupture of the cells by the too rapid escape of moisture, or from the silicious coating of the seed having been destroyed, rendering it less able to withstand the effects of a high temperature, I am unable to say. However, I have not found it beneficial to steep seed before sowing, when there is less than 10 per cent. of moisture in the soil, or when the temperature in the shade, exceeds 80 degrees.

The areas of the different plots, the quantities of seed sown, and the dates of the sowings are as follow:

	Area in yards.	Date of sowing.	Actual amount of seed sown.	Seed sown per acre.
			Pounds.	Pounds.
Plot 1	5,774	October 12	36	30
" 2	10,647	" 18	54	25
" 3	6,044	" 31	40	32
" 4	4,918	" 26	27	26
Total...	.....	.....	157	......

4. *Cultivation.*—The land being in good order, a deep ploughing and a single cultivation at right angles to the line of the plough was sufficient to prepare it for ridging. Ridging was performed by the double mould board-plough. The drills were placed thirty-six inches apart; the manure was spread in the open furrows between the drills. To Plot 1, it was applied at the rate of twenty-five tons per acre; to Plot 2, at the rate of fifteen tons; and to Plot 3, at the rate of twenty tons. To Plot 1 in addition two cwt. of bone-dust was applied. No manure was applied to Plot 4, the soil being in good condition, having carried no grain-crop since it was reclaimed from the jungle. After spreading the manure, the ridges or drills were split through the centre by the double mould board-plough, the soil falling on the manure on either side, and forming new drills. These drills were then consolidated and reduced to half their height by a single operation of the chain-harrows. A uniform seed-bed being formed, a gang of coolies then passed along the drills, making holes about two inches deep and ten or twelve inches apart. Into these holes the seeds were deposited by a gang of coolies following. Another turn of the chain-harrows completed the work.

The after-cultivation consisted of two hand-hoeings and three bullock-hoeings. So effectual was this cultivation that, after harvesting the maize, it was only necessary to plough once, to

prepare for gram, no weeding or any other cultivation being requisite. Estimating a pair of bullocks, driver, etc., to cost 12 annas per day, and a cooly Rupees 5 per month, the average cost per acre will be nearly as follows:

	Rs.	As.	P.
1 Ploughing	1	0	0
1 Cultivating	0	6	0
Collecting weed	0	12	0
1 Chain-harrowing	0	2	0
Ridging	0	8	0
Spreading manure . . .	0	6	0
Splitting ridges	0	8	0
1 Chain-harrowing	0	2	0
Seed, $28\frac{1}{2}$ lbs.	0	10	0
Preparation of seed and sowing ...	0	12	0
Cultivation during growth-			
2 Hand-hoeings . ..	2	0	0
3 Bullock-hoeings ..	1	8	0
Scaring birds . ..	0	8	0
	9	2	0

5. The farm-yard manure was worth 1 Rupee per ton, and the bone-dust, $2\frac{1}{2}$ Rupees per cwt. As these were only "four months' crops," and as they would appropriate only a very small proportion of the manure applied, it would be *unfair* to debit them with the whole cost of the manure. In this country there is no reliable data for calculating the duration of a manure: in England it is usual on heavy soils to charge farm-yard manure over four years; and on light soils, over three years. However, I am not acquainted with any cultivated soils in England so poor as those constituting this Farm, and will, in these calculations, assume that the fertilising effects of fold-yard manure will only continue to operate during two years, and of bone-dust, during three years.

Observations during growth. The plants appeared above ground four or five days after sowing, and in a fortnight after, were six inches high. At the end of six weeks they began to flower, when their heights varied from six to seven feet. The weather was favourable during the early growth of the crop, and during the month of November especially so. The temperature in the shade ranged from 72 to 78 degrees and showers were very frequent. Rain fell on twenty days in November, the total fall being 8·35 inches: during December the weather was not so favourable, though the showers between the 11th and 16th were very beneficial. Rain fell on nine days during this month, the total fall being 5·24 inches. No rain fell between the 25th of December and 15th January, and in consequence the crops suffered

severely, many fine plants withering from the deficiency of moisture—the fact that nine-tenths of the soil consisted of sand must be remembered. On the 16th of January, a severe storm of wind and rain broke over this district, and the whole of the plants in Plots 1 and 2 were levelled to the ground: considerable damage was done to the plants on Plots 3 and 4. However, on these the cobs were just beginning to form, and the destruction was not so complete. It was deemed absolutely necessary to cut down at once the whole of the crop on Plots 1 and 2. Before this storm took place the appearance these crops presented was very fine: the plants were from ten to eleven feet high, and many of the stalks at half their height were four inches in circumference, and the crops were level and uniform throughout.

6. *Harvesting.*—Only about a month having elapsed since the bulk of the plants on Plots 1 and 2 were in flower, much the greatest proportion of the cobs were green and immature when this storm occurred—indeed, not 5 per cent. of the cobs were fit for gathering. It was useless, under the circumstances to leave them longer in the field; we therefore commenced gathering the cobs on the 17th. They were easily broken off with the hand: they were then carted to the shed, and peeling commenced immediately afterwards. The outer skin was entirely removed, and the inner skin merely turned back so as to expose the grain to the free action of the air. By means of the inner skin the cobs were tied together in pairs; they were suspended over ropes stretched across the rooms where they remained until fit for shelling. The cobs being so thoroughly soaked by the heavy rain, it was necessary, in order to prevent the corn moulding or sprouting, to dry them as rapidly as possible. Under ordinary circumstances, in a dry climate like this, I would prefer to leave the skin on the cobs until the grain is glazed and fully hardened. When the skin is removed too early, the grain dries very quickly, and the sample is shrivelled and inferior. Neither would it be necessary to suspend the cobs over lines, as was done in the instances recorded. If well matured and gathered during favourable weather, very simple precautions will suffice, to prevent the corn heating. The fresh cobs before peeling weighed as follows:

	Actual weight.			Weight per acre.		
	Tons.	Cwt.	lbs.	Tons.	Cwt.	lbs.
Plot 1	3	3	24	2	12	13
„ 2	3	5	102	1	9	92
„ 3	0	17	28	0	12	105
„ 4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

After the removal of the cobs the straw was cut down, and after drying, was stacked. When prefectly dry and fit for stacking, it weighed as follows:

	Actual weight.			Weight per acre.		
	Tons.	Cwt.	lbs.	Tons.	Cwt.	lbs.
Plot 1	3	6	64	2	4	16
" 2	3	15	11	1	14	0
" 3	3	4	103	2	11	10
" 4	3	8	49	3	7	39

The straw was very rich in saccharine matters—indeed it was so sweet, that I frequently noticed the coolies with pieces in their hand eating it, as they would eat sugar-cane. It was farmed for consumption during the hot season. All kinds of stock are particularly fond of it. The average cost per acre for harvesting, etc., was as follows:

	Rs.	As.	P.
Gathering cobs	1	8	0
Carting do.	0	6	0
Peeling, tieing, hanging, etc.	1	8	0
Shelling cobs, etc.	0	8	0
Reaping and sheafing straw	1	0	0
Carting, etc.	0	12	0
Total ...	4	10	0

The shelling of the cobs was chiefly performed by a small maize-sheller made by Mr. W. G. Ainsworth, Sydney. With this machine two men can shell 450 pounds of cobs per hour. The cost of the machine is about fifty shillings in Australia. The work is done very satisfactorily. A large shelling-machine, made by Ransomes and Sims, was occasionally employed, but the work done by it was much more costly: it required three men to work it, and only husked 350 lbs. of cobs per hour. This machine cost £10 in England. It does not separate the corn satisfactorily.

7. *Yield of grain, etc.*—The grain was not weighed until it was thoroughly dried—indeed, not until it was in a condition fit for packing: the returns are therefore 15 or 20 per cent. lower than they would have been, had it been weighed in ordinary marketable condition. The following returns show the weight of grain obtained:

	Actual weight.	Weight per acre.
	Pounds.	Pounds.
Plot 1	1,851	1,551
„ 2	1,877	854
„ 3	1,063	851
„ 4	850	836

As issued for seed, the sample contained 96 per cent. of vital grain. One Madras measure weighed 2 lbs. $12\frac{3}{4}$ ounces; and when dried at 212 degrees Fahrenheit, 85 grains weighed 1 ounce. When thoroughly seasoned, 20 average-sized cobs yielded from 7 to $7\frac{1}{2}$ pounds of maize. I have no personal knowledge of the proportion of corn that average-sized, native-grown cobs yield. The following is the only instance bearing on the subject that has come within my *own* knowledge: Being anxious to experiment with maize, a supply was obtained in the Vellore District: it consisted of 10,300 cobs of the yellow variety. After drying, the cobs were shelled, and the total yield of grain was only 338 pounds. Thirty cobs only yielded one pound of grain: thus one Queensland Maize-cob yielded more grain than 12 of the Vellore cobs.

Financial Results.—Valuing the straw at Rupees 10 per ton, and the grain at Rupees 50 per ton (about 15 measures per Rupee)—prices I would readily give for either straw or grain of similar quality—we have the following results:

	Value of straw per acre.			Value of grain per acre.			Total return per acre.		
	Rs.	As.	P.	Rs.	As.	P.	Rs.	As.	P.
Plot 1	22	1	0	34	9	11	56	10	11
„ 2	17	0	0	19	1	0	36	1	0
„ 3	25	8	0	18	15	0	44	7	0
„ 4	33	8	2	18	10	0	52	2	2

The following is the average cost of production:

	Cost of cultivation per acre.			Proportionate value of manure per acre.			Cost of harvesting per acre.			Total per acre.		
	Rs.	As.	P.	Rs.	As.	P.	Rs.	As.	P.	Rs.	As.	P.
Plot 1	9	2	0	14	2	8	4	10	0	27	14	8
„ 2	9	2	0	7	8	0	4	10	0	21	0	0
„ 3	9	2	0	10	0	0	4	10	0	23	12	0
„ 4	9	2	0	....			4	10	0	13	12	0

The matter will stand thus:

	Plot 1 per acre.			Plot 2 per acre			Plot 3 per acre.			Plot 4 per acre.		
	Rs.	As.	P.	Rs.	As.	P.	Rs.	As.	P.	Rs.	As.	P.
Value of straw and grain	56	10	11	36	1	0	44	7	0	52	2	2
Cost of production, etc.	27	14	8	21	0	0	23	12	0	13	12	0
Profit per acre .. .	28	12	3	15	1	0	20	11	0	30	6	2

The large profit made on Plot 4 is due altogether to exceptional circumstances. The yield of grain from Plots 1 and 2 would have been much greater had not the effects of the storm caused the crop to be harvested before being matured. In forming any conclusion on the results of these experiments, the wretched nature of the soil must not be lost sight of. Not only is it very poor in the elements of plant-food, but it is physically a bad soil. It parts with its moisture too rapidly, and during hot weather, becomes very hard and compact. However, if such soils—and there is a large area of similar soils in an uncultivated state in this district—will under maize give a profit of 25 Rupees per acre, the profit from maize cultivation on *good soils* must be large.

In the district enjoying the north-east monsoon, maize can be harvested in ample time to allow of a gram-crop being obtained before the hot season commences. Indeed, I question whether gram can be grown under more favourable circumstance than after a well-cultivated maize-crop: the best gram now growing at the Farm is on the land were the maize was grown. The profits from the gram-crop will be sufficient to pay rent and other charges not debited to the maize.

Nutritive value of Maize.—As a food for the people, maize is greatly superior to Ragi, Cumboo, Cholum, etc. Many natives are extremely fond of it: though we protected our crops with the greatest care, it was impossible to prevent a large number of cobs being carried away. In America and several other countries it forms the staple-food of the people; and it is not less valuable as a food for farm-stock. Horses, cattle, sheep, pigs, and poultry eat it and thrive on it. A paragraph has recently been going the round of the Agricultural Newspapers, stating that the London Omnibus Company cleared £ 50,000 last year by substituting Maize for Oats in feeding their horses, and that the horses have done their work better, and have had less disease amongst them than when fed with oats. I have not had an opportunity of experimenting with maize to any extent in feed-

ing horses in this country. I have, however, used a considerable quantity in feeding working-bullocks, and in the manufacture of mutton. Amongst other experiments, the following were made to determine the relative feeding-values of gram and maize, when given to working-cattle and feeding-sheep.

Working-cattle.	February	February 12.	February 22.	March 4.	March 14.	March 24.
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Weight of the pair fed on *Maize* ...	1,762	1,765	1,799	1,806	1,806	1,823
Weight of the pair fed on Gram ...	1,765	1,789	1,767	1,759	1,786	1,768

The animals were fed per day as below:

1 Pair... { 6 lbs. of Maize.
5 ,, of Tour.
100 ,, of Cholum fodder.

1 ,, ... { 6 ,, of Gram.
5 ,, of Tour.
100 ,, of Cholum fodder.

To be quite sure *that the animals were similarly worked*, I gave one animal in each pair gram, and one animal in each pair maize. Thus:

1 Pair... { 1 Bullock ... ... Gram.
1 ,, ... Maize.

,, ... { 1 Gram.
1 Maize.

For the first few days the maize was not readily eaten: however, at the end of a couple of weeks, they ate it freely, and continued increasing in weight until, at the termination of the experiment, they had increased 71 pounds in weight. The other pair ate gram from the first, but they never made the progress made by the pair fed on maize; and at the termination of the experiment had only increased 3 pounds in weight.

Two lots of sheep, containing 6 wethers each, were put on to feed on the 2nd of February last. Each lot had as much gram-fodder as the animals could eat. Besides the gram-fodder, Lot 1 consumed daily 3 pounds of bran and 6 pounds of maize, and Lot 2, 3 pounds of bran and 6 pounds of gram; the results are as follow:

Date of weighings.	Fed on Gram, Average weight per head.	Fed on Maize, Average weight per head.
	Pounds.	Pounds.
February, 2	38·75	37
„ 12	39	37·33
„ 22	40·83	37·33
March 4	43 83	39 66
„ 14	44·33	42·80
„ 24	45	45

As in the case of the cattle-experiment, so in this case, the maize was novel to the animals, and was not eaten readily during the early part of the experiment. However, as soon as the animals got to like it, they made greater progress than those on gram. At the termination of the experiment those on maize had increased 8 pounds per head, while those on gram had only increased 6·25 pounds per head. Satisfactory as these results are, I believe they would have been more so had the maize and gram been crushed and mixed together before being distributed to the animals. Gram and maize serve different purposes in the animal economy: the former is a flesh or muscle-producer, while the latter is a heat or fat-former.

SUMMARY.

1. The seed is preserved from the attacks of squirrels, crows, etc., when perfectly tarred.

2. It is only advisable to steep the seed when the weather is dull and showery.

3. The seed is best sown on drills about three feet apart with intervals of ten or twelve inches between the seed. It may be planted two inches deep, at the rate of 30 pounds per acre.

4. Maize should always be *well* manured: from fifteen to twenty tons per acre may profitably be applied.

5. The cobs should be well matured before being gathered. If the weather during the harvesting of the crop be favourable, the skins are best kept on the cobs until the seed is perfectly hardened and glazed.

6. From 2½ to 3 tons of dry straw per acre may be expected; it is rich in saccharine matters, and is valuable for all kind of farm-stock.

7. On good soils 2,000 pounds of grain may be grown per acre without extraordinary management.

8. One average-sized Queensland cob yielded more grain than 12 of the cobs grown in the Vellore District.

9. The average cost of production may be estimated at Rupees 25, while the gross return will vary according to the quality of the soil from Rupees 50 to Rupees 60 per acre.

10. The profit may vary from 25 to 30 Rupees per acre according to the quality of the soil: the better the cultivation, the larger the profits.

11. Queensland Maize is only a 4 month crop, and may be harvested in time to allow of a crop of Gram being grown before the commencement of the hot season.

12. Maize is valuable as a food for the people, more so, indeed, than ragi, cholum, cumboo, &c., generally cultivated in this district.

13. Maize is valuable for all kind of farm-stock. Working bullocks fed on Maize increased 71 pounds in weight, whilst those fed on a similar quantity of Gram only increased 3 pounds.

14. Sheep yield more mutton when fed on Maize than on Gram.

15. Maize can be sold at 50 Rupees per ton, and leave a handsome profit to the cultivator.

16. The large quantity of straw yielded by a crop of Maize renders this crop particularly valuable in a country like this.

17. Maize can be profitably cultivated on a soil so poor as one containing 90 per cent. of sand; but the better the soil, the better will be the crop.

18. Maize for feeding-purposes is best given crushed and mixed with some other food.

(Signed) W. R. ROBERTSON,
Supt., Govt. Experimental Farm.

SYDAPET;
2nd April, 1870.

Monthly Proceedings of the Society.

ANNIVERSARY GENERAL MEETING.

Wednesday, the 20th January 1870.

J. A. CRAWFORD, ESQ., *President, in the Chair.*

THE Proceedings of the last Monthly Meeting having been read and confirmed, the Members proceeded, in accordance with the Bye-laws, to the election of Officers and Council for the current year. The Scrutineers (Messrs. J. Lynam and A. Rogers) reported the result to be as follows :—

President—Mr. J. A. Crawford, C.S.

Vice-Presidents—Baboo Peary Chand Mittra, Dr. C. Fabre Tonnerre, Mr. W. Stalkartt, and Colonel E. H. C. Wintle.

Secretary—Mr. A. H. Blechynden.

Council—Mr. A. H. Mowbray, Mr. L. Berkeley, Mr. S. H. Robinson, Mr. A. Stirling, Baboo Ramanauth Tagore, Rajah Suttyanund Ghosal, Mr. R. Blechynden, Mr. W. Pigott, Mr. S. P. Griffiths, Mr. M. Henderson, Mr. B. D. Colvin, and Mr. J. M. Ross.

Standing Committees—The name of Mr. John Thomas was added to the Cotton Committee, Rajah Suttyanund Ghosal to the Grain Committee, Mr. W. Stalkartt to the House Committee, Messrs. S. P. Griffiths and John Thomas to the Tea Committee.

The President next submitted the Annual Report, which was adopted.

The ordinary business was then proceeded with, and the following gentlemen proposed at the last Meeting, were elected Members :—

Corresponding Member—Mr. Charles Brownlow.

Ordinary Members—Messrs. J. H. Carter, C.S., H. H. Sutherland, T. S. Hindhaugh, Captain W. L. Murray, Rajah Niladhur Sing Deo Bahadoor, and the Manager of the Mahmara Tea Plantation in Upper Assam.

The names of the following gentlemen were submitted as candidates for election :—

Lieutenant-Colonel W. J. Ward, 8th Bengal Cavalry, Meerut,—proposed by Mr. T. M. Gibbon, seconded by Mr. J. A. Crawford.

G. Fraser, Esq., Indigo Planter, Gopalpore Factory, Jaunpore,—proposed by Mr. J. D. Gash, seconded by the Secretary.

Murdan Ali Khan, Prime Minister of Marwar,—proposed by the President, seconded by the Secretary.

Assistant Forest Conservator, Jounseer Division, North-West Provinces,—proposed by the Secretary, seconded by the President.

Captain W. G. Hughes (Madras S.C.), Deputy Commissioner, Toungboo,—proposed by Colonel W. G. Owen, seconded by the Secretary.

Captain W. Franklin, H. M's 76th Foot, Toungboo,—proposed by Colonel Owen, seconded by the Secretary.

Lieut. E. H. Steel, R.A., Revenue Survey, Assam,—proposed by Mr. J. M. Wood, seconded by the Secretary.

F. C. Moran, Esq., Manager, Runggorah Factory, Debrooghur,—proposed by Mr. Wood, seconded by the Secretary.

Thomas Fingland Hamilton, Esq., Merchant, Calcutta,—proposed by Mr. D. T. Shaw, seconded by the President.

George Con , Esq. (Messrs. W. Moran and Co.),—proposed by Mr. S. P. Griffiths, seconded by Mr. J. G. Meugens.

Thomas Newton, Esq., Barrister-at-law, Allahabad,—proposed by Mr. C. H. Wilson, seconded by Mr. S. H. Robinson.

Manager of the Chincoory Tea Estate, Cachar,—proposed by Mr. Griffiths, seconded by Mr. Meugens.

The Secretary intimated that Roy Duckina Runjun Mookerjee, Bahadoor, Talookdar in Bengal and Oudh, wished to rejoin the Society.—Agreed to.

The following contributions were announced:—

1.—Annual Report of the Administration of the Bengal Presidency for 1868-69; of Oude, Coorg, Mysore, Central Provinces and Hyderabad Assigned Districts for 1868-69; and of the Bombay Presidency for 1867-68,—from the Government of Bengal.

2.—Annals of Indian Administration for 1866-67, Vol. XII., Part 4, and Vol. XIII for 1867-68,—from the Government of Bengal.

3.—Selections from Records "Indebtedness of Cultivators,"—from the Commissioner of Oudh.

4.—An Enumeration of the Plants of Sikhim,—from Dr. Thomas Anderson.

5.—Journal, Asiatic Society of Bengal, Part 2, No. 4, 1869,—from the Society.

6.—Memoirs of the Geological Survey of India, Vol. VII., Part 1,—from the Superintendent.

7.—Two casks of Crofton's patent Chemical Manure,—from the Government of Bengal. This is the manure of which particulars were published in the Proceedings of the August Meeting of last year.—It was agreed that the same be advertised for general distribution.

8.—A supply of the beans of *Mucuna utilis* ("Pois noire" of Mauritius and Bourbon),—from A. Galstin, Esq. The Secretary mentioned that Mr. Galstin presented the Society with large quantities of this bean in February and April 1868, and that full particulars respecting it are introduced in the Proceedings of the Meetings held in those months.

9.—A few large Kookie beans from Cachar,—from C. Brownlow, Esq. Mr. Brownlow remarks that the seeds alone, and not the pod, are eaten by the Kookies.

10.—A few bulbs of a *Kæmpferia* from Rangoon,—from H. Krauss, Esq.

11.—A collection of Himalayan seeds collected during the past season,—from G. P. Paul, Esq.

A recommendation was brought up from the Council for a monthly increase of pay of Rs. 50 for the Secretary's establishment, and unanimously agreed to.

Read a letter from the Inspector-General of Ordnance, intimating his inability to supply tents for the proposed Horticultural Exhibition; whereupon it was proposed by Baboo Peary Chand Mittra, seconded by Rajah Suttyanund Ghosal, and agreed—"That it is desirable to avoid the general disappointment which has resulted from the discontinuance of the Society's Shows, and that the following Committee be appointed to deal absolutely with the purchase of tents at a cost of Rs. 3,500, and that a Show be held as soon as possible,—namely, Messrs. S. P. Griffiths, A. Rogers, and Dr. Tonnerre."

COTTON.

Read the Report of the Committee (Messrs. A. Stirling, J. M. Ross, and John Thomas) on sundry specimens of Cotton submitted by Mr. Galstin at the last Meeting.

Read also a supplementary letter from Mr. Galstin, and placed on the table the additional specimens therein referred to, which were referred to the Committee for report :—

"According to promise I have much pleasure in forwarding 7 packets containing samples of the several kinds of Cotton grown by me in Entally and Tengra, and trust they will meet with the approval of your Society's Cotton Committee. Annexed you will find a Memorandum of each description of cotton, as also copy of a letter addressed to the Secretary of the Bengal Chamber of Commerce, to which I beg to draw the attention of your Committee. In addition to the particulars annexed, I beg to state that the sowings should be commenced in April and continued till the middle of June. To my careful experience an acre of ground should not contain more than 1,440 foreign cotton plants; a surface of 8 feet by 6 being allowed to every 4 plants, and twice that number of Hingun Ghat and other indigenous kinds of cotton plants, should cover an acre, or 2,880 plants, with a surface 4 feet by 3 for every 4 plants. I am fully convinced that the yield of each plant of the former kind will be a pound of cotton with seed; and, allowing a most liberal expense, the cost of cultivation—all items inclusive—will amount to Rs. 75 per acre until the cotton reaches the Calcutta market. Now, the yield from an acre will be 1,440 lbs. seed cotton, a fourth of which, or 360 lbs. will be cotton; and allowing 60 lbs. of it to be damaged or inferior, an acre will produce 300 lbs. good clean cotton at a cost of 150 shillings, and at the least 9 cwt. of cotton seed, which calculating at 3 shillings a cwt., will make the value of the seed 27 shillings. The 60 lbs. of damaged cotton at *2d.* per lb. will be 10 shillings. Deducting 27 shillings for the seeds, and 10 shillings for the damaged

cotton, the cost of 300 lbs. of clean cotton will thus be reduced to 113 shillings or $4\frac{3}{25}d.$ per lb., and the cotton samples sent herewith, at the present rate of the Liverpool market, will be worth from 10 to 13*d.* per lb. This statement I shall be glad to prove the accuracy of in practice."

In connection with the above the Secretary read the following extract of a letter from Lieut. J. F. Pogson, of Umballa, on the suitability of the hills for raising cotton for seed for distribution in the plains:—

"I observe that the cotton supply question is attracting a good deal of attention, and that the Secretary of State for India has sent out three English gardeners to be placed in charge of "cotton seed gardens," and the result of their practical experience will, I am sure, be very beneficial in securing a good supply of first-class seed. But now comes the rub—cotton seed acclimatized in Western India, will not answer in Northern India. Hence the failure of the Hingun Ghât cotton seed in the Punjab and North-Western Provinces. My idea on the subject is, that the proper place for acclimatizing Hingun Ghât, and any other superior cotton seed (Dacca, for any other inland variety), is in the hills. A good deal of cotton is grown between Subathoo and Simla, partly in the Burowlee district, which is British, and partly in the Hurrepore and Kooneehar districts, belonging to Putteeala, and Kooneehar. The soil being peculiarly fitted for cotton—the cultivation of which is perfectly well understood by the agriculturists of the locality—points it out as a proper spot for the acclimatization of exotic or superior cotton seed.

"The cotton seed is sown in March-April, and it is harvested in October-November. The Hingun Ghât cotton seed would, if *acclimatized* in this locality, most probably ripen in November-December in the plains. But if it did not, the *constitution* of the plant would be so exalted that it would bear any degree of cold to which it might be subjected in the plains. Hurreepore is about 3,500 feet above the sea-level, and Burowlee 2,500 to 3,000, and the soil is rich in iron, lime, and potash. The rains cease in September, and the heat is ample to ripen the cotton long before the frost sets in. The cotton of Hurreepore is very good, and it is worked up into yarn and cloth by the agriculturists, who are, to a great extent, weavers by caste.

"What I would suggest is, that a sufficient supply of Hingun Ghât cotton seed be placed at the disposal of the Deputy Commissioner of Simla, and General Reynell Taylor, the Commissioner and Agent to Government, Cis-Sutledge States, for gratuitous disposal amongst the cotton cultivating zemindars, and '*assamees*,' of these places named. The recipients of the seed should be informed that the cotton is to be their property, and that the Government or 'Cotton Commission' will purchase all the seed produced, at an advance of $12\frac{1}{2}$ per cent. on the ordinary "Binowla,"* or common cotton seed of the district. If this plan be introduced, the locality indicated would become the cotton seed district of Upper India and the Punjab, and in a few years superior cotton seed would come to be

sold much in the same way that Indigo seed is now sold to the Indigo Planters of Bengal, into whose hands I predict that the cotton trade of the future will pass.

"It is very remarkable that Kohat, in the Punjab, is the most productive cotton district, the produce per acre being over 275lbs. of clean cotton. The soil is a red calcareous clay, which will grow almost any description of cotton to advantage.

"The annually increasing demand for cotton will, in my humble opinion, never be met, until a variety, now completely neglected, is taken in hand, introduced, and the cultivation fostered in this (Bengal) Presidency. The variety I allude to is the "Gossypium Arboreum," or "Religious Cotton," called in Tamil "Shemparatic," and which would seem to be peculiarly adapted for cultivation in the Dehra Dhoon. I should be much obliged if placed in possession of a pound or more of this seed, and will write further on the subject hereafter."

Mr. Rivett-Carnac (Cotton Commissioner for the Central Provinces and the Berars), remarked, that Mr. Pogson's suggestions were, in his opinion, well worthy of trial, and expressed his readiness to supply the required seed. This offer was thankfully accepted.

Read a letter from H. Rivett-Carnac, Esq., dated Nagpore, 4th January, forwarding for the information of the Society, copies of his reports addressed to the Bombay Chamber of Commerce, on the state of the weather and prospects of the Cotton crop in the Central Provinces and the Berars.

The following communications were likewise submitted:—

From the Under-Secretary, Government of Bengal, applying for eggs of the Eria silk moth for the acclimatization Society of Victoria, Melbourne.

The Secretary intimated that he had been able to meet this requisition satisfactorily, through the obliging kindness of Mr. Charles Brownlow, the Society's Corresponding Member in Cachar.

From the Under-Secretary, Government of India, applying for permission for a reprint of Capt. Thomas Hutton's remarks on the cultivation of silk in India from the Society's Journal, Vol. 1, New Series, as copies are required for distribution amongst the local Governments and Administrations.—Agreed to.

From Vause Frettwell, Esq., Corresponding Member at Kandeish, applying for certain seeds in addition to those already granted. Mr. Frettwell states that though, owing to the deficit, the Government Model Farm will cease to exist at the close of 1869, he is desirous of carrying on experiments on his own account.

The following Orchids were exhibited:—

By Mr. A. H. Mowbray.—Two plants in flower of *Eria lanata*, and one of *Saccolabium giganteum*;—four marks were awarded to the former, and three to the latter

By Mr. John Lynam.—A plant in flower of *Saccolabium giganteum*, to which three marks were awarded.

Wednesday, the 16th February 1870.

Dr. C. Fabre Tonnerre, V. P., *in the Chair.*

The Proceedings of the Aniversary General Meeting were read and confirmed, and the gentlemen then proposed were elected Members—Lieutenant-Colonel W. J. Ward; Murdun Ali Khan; Assistant Forest Conservator, Jounseer Division; Captain W. G. Hughes, Captain W. Franklin, Lieutenant E. H. Steel, Messrs. G. Fraser, F. C. Moran, T. F. Hamilton, George Conti, Thomas Newton, and the Manager of the Chincoory Tea Estate, Cachar.

The names of the following gentlemen were submitted as candidates for election:—

R. W. Hall, Esq., Balladhun Garden, Cachar,—proposed by Mr. H. H. Sutherland, seconded by the Secretary.

W. F. Gibbon, Esq., Senior, Doolh. Factory, Goruckpore,—proposed by Mr. J. H. Bridgman, seconded by the Secretary.

Andrew W. Murdoch, Esq., C.E., Serajgunge,—proposed by Mr. S. I. Griffiths, seconded by Mr. J. G. Meugens.

H. B. Sterndale, Esq., Bank of Bengal, Delhi,—proposed by Mr. Griffiths, seconded by Mr. J. A. Crawford.

Adam Anthony, Esq., First Assistant Accountant General, Allahabad,—proposed by Mr. Samuel Jennings, seconded by the Secretary.

Henry Thompson, Esq., Manager, Moran Tea Company,—proposed by Mr. E. Shearin, seconded by Mr. S. H. Robinson.

Liuetenant Frederick Bailey, Royal Engineers, Chukrata,—proposed by Lieutenant-Colonel F. R. Maunsell, R.E., seconded by Dr. Tonnerre.

Dr. J. Fawcus, Officiating Superintendent, Alipore Jail,—proposed by Colonel E. H. C. Wintle, seconded by the Secretary.

Rejoined—Lieut.-Col. F. R. Maunsell, R.E.

The following contributions were announced:—

1.—Report by Mr. Lumley on the Tea Trade of Russia,—from the Foreign Department.

2.—Patent Office Report for 1866 (3 vols.), and Report for 1867 of the Department of Agriculture,—from the United States Government.

3.—Annual Report of the Cape of Good Hope Agricultural Society for 1869, and the culture of the White Mulberry in the Cape Colony,—from the Society.

4.—Report of the Smithsonian Institution for 1867,—from the Institution.

5.—Report on the Vegetation of the Andaman Islands, by Mr. S. Kurz,—from the Author.

6.—Journal of the Asiatic Society of Bengal, Part I, No. IV, 1869,—from the Society.

7.—Seed of the Pea-violet *(Crotalaria occulta)*,—from C. K. Hudson, Esq.

8.—A small quantity (7 seers) of Egyptian Cotton Seed,—from C. B. Clarke, Esq., Officiating Superintendent, Royal Botanic Garden.

9.—Seed of some very fine kinds of Onion,—from A. Grote, Esq. Mr. Grote states that these onions were exhibited by Messrs. James Carter & Co., at a recent Show of the Royal Horticultural Society of London. They were certificated, and attracted great attention, being the size of a large fist. The varieties were from S. Europe and N. Africa.

10.—A collection of Coniferous seeds from the Himalaya,—from Dr. Jameson, Superintendent, Royal Botanic Garden, Saharunpore.

11.—A small assortment of tubers of Achimenes of four sorts,—from A. E. Russell, Esq.

12.—A sample of a Fibre from the Nicobars, also of Flour, made by the Islanders from the fruit of a palm,—from Colonel H. Man. Agreed to request a few particulars from Colonel Man in respect to the farina.

Read the following report of the "Tent Committee" (Dr. Tonnerre, Messrs. S. P. Griffiths and A. Rogers) on the subject referred to them at the last Meeting :—

"The Committee appointed at the last Monthly Meeting regret to report that, having entirely failed in their endeavours to obtain the necessary number of tents, either on loan or by purchase, they have been obliged to abandon having a Show this month in the open air. They would, however, recommend that a Show, on a modified scale, be held in the Society's Rooms on some day in April, the same to be fixed at the Monthly Meeting in March at which a good collection of plants of a rarer description, such as Orchids and the Bulbous tribe, can be submitted.

"In order to be prepared against such a contingency in future, the Committee recommend further, that the amount voted at the last Monthly Meeting (Rs. 3,500), be applied for the manufacture, at the commencement of next cold season, of the full number of tents that are required for these periodical exhibitions, so that the first show of the season may be held about the usual time—namely, the close of January."

Tea.

The following recommendation was submitted from the Council :—

"That it is desirable to offer a money premium for the best treatise on the cultivation of the Tea plant and manufacture of Tea, and that a sum of Rs. 500 be granted for that purpose."

The recommendation was adopted, and it was further resolved, that the Council be requested to submit full suggestions for the guidance of intending competitors, and that at least nine months' full notice be given.

Cotton.

Read the following letter from Mr. S. H. Robinson, in reference to sundry samples of Cotton raised in the suburbs of Calcutta, which were submitted by Mr. Galstin at the December Meeting, and reported on by the Committee at the last meeting :—

"As promised, I now send you the following report on the four samples of Cotton grown at Entally by Mr. Galstin. It is furnished by Mr. Morris, the Manager of the Goosery Cotton Mills, and may be valuable as the opinion of a practical manufacturer, well acquainted with the Liverpool market.

No. 1; good, long and fine staple, but, rather knippy, and not very strong; would class with Egyptian;—worth 14*d.* per ℔ in present market, and if it had not been knippy would have been worth 16*d.*

No. 2; fine staple,—like Hingunghat but weaker;—worth about 9*d.*

Sea Island, Tangra,—is of a quality between Nos. 1 and 2. Clean fibre, rather long, but shorter than ordinary Sea Island, though strong;—worth fully 12*d.*

New Orleans, Tangra,—very strong and clean, but rather coarse; average length, but rather irregular. Compares well with New Orleans from America;—worth about 13*d.*

"The character of 'knippy,' in No. 1 sample, refers to the appearance of small knots in the fibre: these make it difficult to work, and will not give a clean thread. I have noticed it in other exotic cottons grown in India; generally in produce from plants of the second or third years' growth.

"These samples afford another striking proof that superior classes of Cotton can be grown in lower Bengal with little difficulty, and make it still more desirable that the experiment of their growth should be contrasted on a sufficient area and scale to test fairly the cost of their production.

"I understand the Government have introduced some experiments in the growth of exotic Cotton in the Government Botanical Garden, where they have about three beegas of plants now under cultivation; and I beg to suggest that the Society apply to Government for a return of the cost of cultivation, mode of culture, and yield per acre; with samples of the produce, for the information of the Society."

Resolved—That Mr. Robinson's suggestions be acted on.

Read reports by a section of the Committee (Messrs. Ross and Stirling) on some additional samples of Cotton from Mr. Galstin, which were laid before the last Meeting.

Report by Mr. J. M. Ross.—No. 1. Staple about 1 30-100ths or equal to the shortest Egyptian; should say that this has been either from Sea Island or Egyptian seed, but the Cotton has greatly degenerated from some cause or other. It is still, however, a valuable cotton, silky and strong, but poor in color.

No. 2. Staple about 90-100ths inch., a fair length for indigenous Cotton; good color and strong. Reminds me of Hingunghaut.

No. 3. Staple about 1 20-100ths inch., or considerably deteriorated from the average length of Egyptian cotton, dull in color and stained, strong fibre. A valuable cotton, however, but not equal to No. 1.

No. 4. Staple about 1 40-100ths inch., I think this can scarcely have been grown from Sea Island seed; if so, it has lost greatly in length of staple; perhaps it has

lost by its proximity to inferior cotton; otherwise it is a fine, silky cotton of considerable value.

No. 5. Staple about 1 10-100ths inch. This appears to have deteriorated less than the other samples I have reported on. It is a good strong, white and silky cotton, and would sell well.

No. 6. The same remarks apply here; the sample is not, however, so clean or free from stains.

No. 7. Harsh and coarse in texture; short staple, and much stained; would probably pass as fair Bengal, although the staple is rather short.

Report by Mr. A. Stirling.—In the main I agree with Mr. Ross' remarks on these samples though I think the staple of Nos. 2, 3 and 4, more irregular than he seems to have found it; I should say he over-estimates the strength of the staple of No. 5. I should say of the whole, No. 5 is the Cotton, to the growth of which Mr. Galstin should turn his attention, if he continues his experiments; as it is a class, the sale of which would be on a larger scale than that of longer staples. I have been struck by the cleanness of these samples, and the absence of seed.

Read a letter from the Secretary to the Government of India in the Home Department, applying for sample of indigenous Cottons, on behalf of Dr. G. Bernoulli of Guatemala.—To be complied with.

In connection with the foregoing the Secretary submitted a paper from Lieutenant J. F. Pogson of Umballa on *Gossypium arboreum.* Referred to the Committee of Papers.

SILK.

Read the following letter from the Secretary, Cape of Good Hope Agricultural Society, and submitted report on the sample of raw silk therein referred to:—

"I have to acknowledge with best thanks Part III, Vol. 1, 1869 of your Society's Journal, and also the kind efforts that you have made to furnish us with some silk worm eggs of the annual kind. Hitherto we have obtained eggs from France, Germany, and Japan, though I regret to add the worms from them have, in a *few* instances, been attacked with disease which may, we think, be attributed to the humidity of the atmosphere. There are, however, many parts perfectly dry and healthy, and from these we are about to send seed to the European markets. I enclose, according to your request, a skein of Cape-grown silk from French worms, fed only on the 'Morus alba'; and shall be glad to receive your report on its quality after comparison with Bengal silk.

The Cape Government have already sent a lady to Europe to learn the art of reeling, &c.; and on her return, in February next, I will send you further samples. Any information on this interesting subject will be very acceptable. I have already derived many useful hints from the perusal of your Journal; and shall feel much pleasure if I can be of any service to your Society."

Report by Mr. T. R. Grant.—I have with pleasure examined the sample of Cape silk. It is extremely good, well made, even, very elastic thread, and good

mellow color. Without reeling it is difficult to name its exact value; that in London to-day, I should think, about 28 to 30 shillings per lb.

Report by Mr. E. G. Buskin.—Good color and quality, but coarse in size and uneaven in thread, also wanting in twist; if reeled with more care would be an excellent silk, as it is evidently made from cocoons of very superior quality. Difficult to value, being such a small sample, probably worth in the market Rs. 24.

Opium.

Read a letter from Mr. J. F. Peppè, of the Opium Agency, Chôta Nagpore, requesting to be furnished through the agency of the Society with a few seers of Kangra poppy seed, as he believes that it would suit the climate of Chôta Nagpore better than that from the plains.

The Secretary mentioned that knowing the interest evinced by Lieutenant J. F. Pogson on this subject, as shown by his correspondence with the Society in 1862-63, he had addressed him for assistance, and the following is his reply:—

"In reference to the subject of aiding Mr. Peppè in obtaining Kangra poppy seed, for sowing in the Chôta Nagpore district, all I can do is to suggest that an application be made to Mr. T. D. Forsyth, C.B., Commissioner of Jullundor and Kangra, who will no doubt arrange for the seed being supplied, and, if properly manured, and looked after, satisfactory results would follow.

"The Agriculturists of certain parts of China have entered into the opium trade, with the full intention of driving Indian (Government and Malwa) Opium out of the market, and unless India can supply an opium so very superior to the local article as to make it almost unsaleable, the Opium Revenue must suffer loss.

"The production, therefore, of a very high class or quality of opium becomes a *desideratum*, and if my proposition receives attention, I think India will carry the day.

"The opium made by me at Dounton near Simla, was found to contain twice as much morphia as the best Government opium, and the same seed might give similar results in Chôta Nagpore. But if the value of opium in the China market depends on the richness of the drug in morphia, then, under present circumstances, the interests of Government would be best protected by introducing and cultivating a variety of the poppy plant the opium of which contains from sixteen (16) to twenty-eight (28) per cent of morphia. The best Smyrna opium does not contain more than 6·3 per cent of morphia, whilst the black poppy (variety Nigrum) of France and Germany yields the high percentage stated. I would, therefore, suggest that black poppy seed be obtained from both countries, for cultivation in the Monghyr and Chôta Nagpore Hill districts. The liver-colored, red and yellow soils, met with in these hills, will grow poppy to perfection, and the opium so obtained should be used to raise the quality of the opium of Benares and Behar."

Resolved.—That an application be made to Mr. Forsyth for the Kangra seed, also to Dr. Hooker for the black poppy seed recommended by Mr. Pogson.

MISCELLANEOUS COMMUNICATIONS.

1.—From the Officiating Secretary, Government of Bengal, conveying the thanks of the Lieutenant-Governor for the trouble taken in complying with request for Silkworms eggs for the Acclimatization Society of Melbourne.

2.—From Messrs. Vilmorin, Andrieux & Co., of Paris, acknowledging receipt of order for next season's seeds and promising to give it their best attention.

3.—From Dr. Thomas Anderson, London, forwarding the first portion of his Index of Roxburgh's *Flora Indica.* Dr. Anderson writes—" I enclose 6 pages of Roxburgh's list corrected and filled in up to the latest information here (Kew), on Botanical nomenclature, and I shall send you weekly instalments until you get the whole of it. Every one here thinks the list will be a most useful one. I would advise going to press at once with the manuscript, as you may depend on my sending it regularly."

The Secretary mentioned he had transferred the MS. to Mr. Scott, Curator of the Royal Botanic Garden, who had kindly agreed to correct the proofs.

4.—From Dr. John Anderson, submitting a paper by Mr. Peal, of Assam, regarding the *Ficus* tribe.

5.—From the Honorary Secretary, Government Farm, Madras, forwarding a printed paper regarding the " Yellow Cholum " and its merits as a fodder-crop.

This is apparently a variety of the well-known "Jowar" or "Jowarree" of Upper India, or Great Indian Millet, *Sorghum vulgare.*

6.—From R. W. King, Esq., Ranchee, enquiring if the Society would purchase acclimatized vegetable and flower seeds, if a garden were established by the Municipality. A reply has been sent that the Society's arrangements for the current year were complete; but that they would be glad to purchase next year to a limited amount.

7.—From John Scott, Esq., Curator, Royal Botanic Garden, Calcutta, reporting the germination of the Brazilian Grass Seed (*Panicum spectabile*) presented by Dr. Hooker. The Secretary mentioned he had lost no time, on receipt of this favorable report, in sending small quantities of the seed of this valuable grass to about 25 Members, who were likely to give it every attention, and that there was still some remaining for any one who would like to try it.

8.—From A. H. Mowbray, Esq., requesting to be informed if marks can be given for more than one plant of the same variety at any one Meeting. The Council are of opinion that the judges can exercise a discretion to give additional marks, should there be a good collection of any rare plant exhibited.

Mr. Mowbray exhibited a very fine, healthy plant, in full flower, of *Dendrobium fimbriatum occulatum,* for which 4 marks were awarded; of *Dendrobuim aggregatum* in fine flower, for which 3 marks were awarded; and of *Cypripedium venustum* for which 2 marks were awarded.

Wednesday, 16th March 1870.

Baboo P. C. Mittra, V.P., *in the Chair.*

Read letters of apology from the President and Dr. C. Fabre Tonnerre for not being able to attend.

The Proceedings of the last General Meeting were read and confirmed.

The following gentlemen were elected members—Messrs. R. W. Hall, W. F. Gibbon, A. W. Murdoch, H. B. Sterndale, Adam Anthony, Henry Thompson, Lieut. F. Bailey and Dr. J. Fawcus.

The names of the following were submitted as candidates for election:—

H. H. the Nawab Shah Jehan, Begum of Bhopal,—proposed by Col. Edward Thompson, seconded by the Secretary.

A. Stewart, Esq., Manager, Oornabund Garden, Cachar,—proposed by Mr. George Grace, seconded by the Secretary.

H. S. Clarke, Esq., Manager Borokai Garden, Cachar,—proposed by Mr. Grace, seconded by the Secretary.

Geo. St. Pearce, Esq., Manager, Monickhall Garden, Cachar,—proposed by Mr. Grace, seconded by the Secretary.

Dr. Thos. Beaumont, Presidency Surgeon, Indore,—proposed by Major W. Kincaid, seconded by the Secretary.

S. E. Voigt, Esq., Merchant, Calcutta,—proposed by Mr. W. Pigott, seconded by Mr. A. H Mowbray.

A. C. Pott, Esq., Merchant, Calcutta,—proposed by Mr. S. P. Griffiths, seconded by Mr. W. Stalkartt.

C. T. Inskipp, Esq. (Messrs. W. Moran & Co.),—proposed by Mr. Griffiths, seconded by Mr. J. G. Meugens.

A. Phillips, Esq., Barrister-at-Law, Calcutta,—proposed by Mr. Henry A. Gray, seconded by the Secretary.

Captain H. P. Lovell, Supdt. P. and O. Company, Calcutta,—proposed by the Secretary, seconded by the President.

T. J. Hay, Esq., Manager, Sildoobee Tea Garden, Cachar,—proposed by Mr. Grace, seconded by the Secretary.

T. Connell, Esq., Sildoobee garden,—proposed by Mr. Grace, seconded by the Secretary.

Franklin Prestage, Esq., c.e.,—proposed by Mr. Griffiths, seconded by Mr. Meugens.

Charles E. Price, Esq., Currency Office, Calcutta,—proposed by Mr. L. Berkeley, seconded by Dr. R. F. Thompson.

As a Corresponding Member—Lieut. J. F. Pogson, on the recommendation of the Council.

As an Associate Member—Mr. Geo. Bartlett, on the recommendation of the Council.

The following contributions were announced:—

1.—Records of the Geological Survey of India, vol. 2, parts 2,3 and 4,—from the Government of Bengal.

2.—Monthly Report of the Department of Agriculture of the United States, for November and December, 1869,—from the Consul-General, U.S.A.

3.—A further quantity of Teak Seed,—from J. A. Crawford, Esq.

4.—A few pounds of Egyptian and New Orleans Cotton seed,—from the Secretaries, Manchester Cotton Supply Association.

5.—A small quantity of Sea Island Cotton seed,—from Mr. C. H. Compton.

[The above Teak and Cotton seed are available for general distribution.]

6.—Sample of raw Sugar made on 3rd March, 1870, at the Aska Sugar Works by the "diffusion" process direct from the cane,—from F. J. V. Minchin, Esq.

PRIZE ESSAY FOR THE CULTURE AND MANUFACTURE OF TEA.

The Council submitted, as requested at the last Meeting, full suggestions for the guidance of intending competitors for the prize of Rs. 500, and the Gold Grant medal, for the best treatise on the cultivation of the Tea plant, and manufacture of Tea, and recommend that the offer be open till 1st March 1871. These suggestions were adopted, and it was directed that due publicity be given to the offer.

The Council recommend that the show of orchids, bulbous and such other plants as are in flower at the present time, as also a few kinds of vegetables, be held in the Society's rooms, Metcalfe Hall, on Wednesday, the 6th of April at 10 A.M.—Agreed to.

The Council further submitted a short form of prospectus of the Society, which they think it desirable to circulate with the view of making the usefulness of the Society more generally known, and of adding to its list of Members.—Agreed to.

REPORT ON THE PRESENT STATE OF SILK CULTIVATION IN BENGAL.

The report of a Committee appointed by the Council to consider the above subject was next submitted. (See "Correspondence and Selections" in this part.)

The Report was adopted, and it was agreed that a copy thereof be forwarded to the Government of India.

In connection with the above the Secretary submitted the following communication from Mr. H. Cope, dated 1st February, from Tours in France, respecting Silk cultivation in the Punjab, in reference to Captain Hutton's recent paper on the subject published in the Journal, vol. 1, Part 4 (new series):—

"I have read with the attention they deserve the remarks of Captain T. Hutton on the cultivation of Silk in India, and while I agree with him on the whole that great care must be taken in selecting localities if the English movement for the extension of such cultivation in India should lead to positive results,

there are some points on which I must be permitted to differ with him, especially as to what he considers the impossibility of successfully rearing Silk worms in the plains of the North-west of India especially. He says, at p. 333-34, of part IV, Vol. 1, of the Society's Journal that:—'It must be borne in mind 'that although good silk may from time be produced while the health of the 'insect is unimpaired, even in a climate which will eventually prove injurious to 'the worm, yet the out-turn will never be what it ought to be in a climate 'fully adapted to the constitution of the insect—good Silk was no doubt produced 'in Oudh and the Punjab, but in neither case was the yield commensurate with 'the outlay and expectation of the cultivators.' Again, in the following page:— 'Facts we all know are stubborn things, and they have already solved the 'question by proving that the Upper-Provinces are wholly unsuitable to either 'annuals or multivoltins.' Again at page 349, Captain Hutton says:—'If this '(BOMBYX *Mori*) be one of the species which it may be thought advisable, in 'spite of experience, to introduce into the plains, I say again *Beware*, for the 'result of such an attempt will only prove the truth of the old adage that a fool 'and his money are soon parted.'

"Now I do not mean to say (writing of the Punjab especially) that the experiments made at Lahore or even at Umritsur (where, however, in 1865, I raised a crop of Silk that realized 17 per cent profit), were such as to warrant the commencement of operations in those localities on a large scale, or such as would warrant any English capitalists in laying out a considerable sum with the view of enlarging silk cultivation in Upper India, and so carrying out the views under the auspicies of the Society formed for this particular object, and of which, I believe, Lord William Hay to be President, and Mr. P. L. Simmonds the Secretary. But I do maintain that the operations now carried on for upwards of twenty years in the district of Goordaspoor, and which have been enlarged to a very considerable extent during the last few years, owing to the liberal aid of the Punjab Government in granting money and land to the principal Sericulturist, are far beyond the range of mere experiments, and have proved beyond the possibility of a doubt by the quality of the silk produced and by the continued healthiness of the worm, never supplemented by new importations of eggs from without, that silk worms can be successfully and profitably reared outside though at no great distance from the foot of the Himalayan mountains; and I have no hesitation in saying that, taking Deenanugger (which Lord William Hay knows well as he was district officer there before he went to Simla) as a base of operations and proceeding north and north-east by Pathankote across the Chuckee towards Noorpore very large plantations of mulberry trees might be established, and great silk operations carried on if land can be secured with the aid of Government on reasonable terms. There are between the Chuckee and the Jubbur, running under Noorpore, some two or three thousand acres that would suit admirably.

"The Goordaspore operations are at present limited owing to the difficulty, amounting almost to an impossibility, of obtaining land for plantations. Jaffir Ali Khan, of Daira, on the right bank of the Ravee, the patriarch of the silk movement in Goordaspore, went, as I think, I already mentioned in one of my previous communications, from village to village with the Rs. 500 granted to him by the Punjab Government in his hand asking proprietors to sell him land, and was everywhere met with refusals, and had he not obtained a grant of a portion of the Nynakekote encamping ground, no longer required for military purposes, he must have continued to limit his operations to his old grounds. But increased mulberry cultivation brought an augmentation of produce without any diminution of proportionate profit or any deterioration in the worm, so that while in 1858, the silk crop of Goordaspore was limited to some 35 seers, (70 lbs) at which figure it had stood for many years, it had increased in 1869 to close upon 8 maunds or nearly Rs. 800 lbs.* the produce commanding a better price in the Umritsur market than the best Bokhara silk, the cultivation having been taken up by several Mahomedan families of Palamkote, Soojanpore, or totally independent of Jaffir Ali and his connexions.

"Facts are stubborn things as Captain Hutton truly remarks, and these are at his service, and I entertain no doubt from those I have detailed that silk might be reared all along the base of the mountain range, wherever water is in sufficient abundance to favor the cultivation of the Mulberry."

Hints for the successful transmission of living plants from Europe to India.

Read a letter from Mr. F. Halsey of Umritsur on the above subject. (See "Correspondence and Selections" in this Part.)

Rice Cultivation.

Read a letter from Lieut. J. F. Pogson on rice cultivation in Upper India, and with reference to experiments to be made in Bengal under sewage:—

"In yesterday's *Delhi Gazette*, received this morning, I observe that the Bengal Government have received a good supply of Carolina Rice seed, or *dhan*, and I should feel very much obliged to you, if put in the way of securing one maund or more of this valuable rice seed I am going to manage a large Estate in the Hills, and as there is a lot of rice land, the introduction of the Carolina rice would be a great benefit conferred on all rice growers. I shall use all my influence with native chiefs and wealthy zemindars, to grow this rice, in preference to inferior or local rice, and as we have a different temperature at every 530 feet of altitude, commencing from 2,000 and up to 4,500 feet, the seed would have a most satisfactory trial, and the zemindars could be made to grow it as "Seed Rice" for sale in the plains.

"The lower parts of 'Burowlee,' 'Kooneehar,' and 'Subathoo,' all produce first class rice, called 'Bansmuttee,' and as a sequitur A. 1. Carolina should thrive in these localities.

* The Maund is a *pukka* one of 96 lbs.—H.C.

"I notice that the Carolina rice in Bengal is to be raised under sewage, which will, I fear, terminate in a failure, because the Government will never get the Bengalees to use sewage in the Chinese fashion, which is as follows—The rice having been sufficiently grown, without manure, (say when it is 9 inches high) is manured with liquid excreta, reduced to solution in tubs, and brought to the rice fields, into which it is started, tub by tub, along with the flowing water, and so each field is manured.

"No Bengalee Agriculturist will make fresh filth into manure in the above manner, and under the circumstances it would be far better to offer prizes for the cultivation of the American rice, leaving the manure used to the discretion of the cultivator.

"Deodorised and *Dis-infected* liquid manure applied to growing grass crops or rice, may, in certain climates, and localities, be harmless to the population. But I fear that utilizing the sewage of Calcutta in this manner will be pestilential. The crops if over-manured will perish, and then the Phosphates and Sulphates present in effete matter will undergo catalytic chemical changes, assume gaseous forms, and poison the atmosphere far and wide."

Wine-producing Capabilities of Tours.

The Secretary next submitted the following extracts of a letter from Mr. H. Cope on the above subject:—

"Although far removed for the present from the ever active scenes of the labours of your Society, I still and hope to continue to take a lively interest in its welfare and progress, and trust I may still be permitted to contribute, however slightly, to the proceedings of an institution in which I have for so many years taken an interest.

"Circumstances have led me to the Capital of one of the richest provinces of France, the Tourraine of pre-Revolutionary times, where vineyards of the first quality are, owing to the peculiarly suitable quality of the soil, as plentiful as rice fields in Bengal, with the immense advantage of their producing neither malaria nor its malignant consequences, or such fevers as frequently decimate your fertile Presidency. In my progress to Tours I may literally say, that from Moulins on the Allier, itself the centre of an agricultural district of the finest character, to Tours on the Loire, following the right bank of the Cher, a tributary of the latter, I have seen little else besides vineyards, and vineyards in every available nook and corner down to the road side, within garden lands inside courtyards, up every wall and over every nook side; each locality producing wines of a quality and flavor peculiar to itself, and all esteemed throughout France, where they are consumed, especially towards the Southern and Atlantic coasts, in the room of the inferior wines exported to England, America, and even India. The red wines of the Cher are especially esteemed, and would long since have commanded attention outside the country had communication with the exterior been available. The new line of railway between Vierzon and Tours. now forms a link in the chain towards Marseilles, that will no doubt be availed

of. And I should not be surprised to hear of some of them finding their way to Calcutta, where they would speedily supersede the so-called produce of the Bordeaux market. But vines do not stand alone in the estimation of the people of Tourraine. Their apples, pears, peaches, &c., find ready sale in the markets of Paris, and the vegetables of the place receive great and especial care. I hope to give you some account of their cultivation, which is a speciality here, and also of the floricultural produce greatly encouraged by the care taken in keeping up a Botanical Garden established some thirty years ago, of which you shall have a more detailed account in the hope that such may be useful to the floriculturists of India. There are also some private gardens of more than provincial celebrity, with the owners of which I hope to establish amicable relations for our mutual advantage."

Cultivation of the Ramie in South Carolina.

The Secretary next submitted the following extract from the *New York Tribune* with which he had been favored by the Hon'ble N. P. Jacobs, U. S. Consul General, regarding the culture of the Ramie or Rheea (China grass) in certain parts of the United States as a substitute for Cotton :—

"The Annual Fair of the State Agricultural and Mechanical Society of this State, which closed on Friday, gives us some noteworthy facts touching the industrial interests of South Carolina. Most significant among the new branches of production is the textile fabric called Ramie, which is beginning to attract attention, and a number of planters are substituting it for cotton. At this Fair there were on exhibition specimens of it in several forms—the stalks, the roots, the soft silky material that is to be spun into thread, and some cloth made from it. The Ramie, of which cloth is made, is, like flax, the bark of the twig-like stalks from which all the woody fibre has been removed by breaking. It is more like silk than cotton; and is much finer than the silk produced in this State from the silk-worm. In its unspun state it is nearly white and has the gloss of silk. The stalks resemble ozier twigs, and is not very unlike flax or hemp. The roots are used to propagate it, and are sold at enormous prices—sometimes a dollar a dozen, or even more. The Ramie is often mixed with cotton to make silk-mixed goods: and often mixed with silk to make "*pure* silk" goods. Col. Joel Foster of Spartanburg, who is State Senator from that county, has entered upon the cultivation of the Ramie. It is a perennial, and once planted will yield for many years. Col. Foster estimates that one man can cultivate 40 acres of Ramie, while about 10 acres is a man's work in caring for cotton. He believes that he can make more money by raising Ramie at three cents a pound (crude) than he can by raising cotton at 20 cents a pound. But Ramie sells in New Orleans at 10 cents; and cotton is worth 25. So that Col. Foster estimates Ramie to be more than four times as remunerative as cotton. This calculation is based upon the supposition that the Ramie shall be sold in its crude state; but a large producer of it would, of course, establish works to refine and manufacture the

fabric, as the gin does the cotton; and thus prepared the Ramie is worth 60 cents a pound. It is not unlikely that a few years will witness a very large increase in the production of Ramie in South Carolina, and the Agricultural Society will be a means of bringing this about."

MISCELLANEOUS COMMUNICATIONS.

1.—From V. Ball, Esq., offering some remarks in reference to the flour made by the Nicobar Islanders from the fruit of a Palm, of which a specimen was presented at the last Meeting by Col. Man. Mr. Ball believes the flour in question to be derived, not from the fruit of a Palm, but from a Pandanus or screw-Pine.

2.—From Under-Secretary, Government of Bengal, conveying the thanks of the Lieut.-Governor for the trouble taken by the Society in the despatch of eggs of the castor-oil silk moth for the Acclimatisation Society of New South Wales at Sydney.

3.—From the Hon'ble Horace Capron, Commissioner of Agriculture for the United States of America, applying for information regarding the Rheea plant (*Bœhmerea nivea*).—Complied with.

4.—From the Superintending Engineer, Behar Circle, requesting the aid of the Society in lining with trees the road from Patna to Gya, which is now nearly finished, and along which there is an enormous amount of traffic.—Complied with.

5.—From Officiating Secretary, Board of Revenue, intimating that on receipt of the Carolina Paddy, daily expected, the Society's application for 60 maunds thereof will be complied with as far as possible.

6.—From H. Rivett Carnac, Esq., Cotton Commissioner for the Central Provinces and the Berars, submitting his Report on the state of the cotton crops for February.

7.—From Messrs. Law, Somner, & Co., Melbourne, intimating their intention of putting in hand the order for another consignment of seeds.

8.—From the Secretary, A. and H. Society, Lahore, returning thanks for seeds of *Panicum spectabile*.

Mr. Mowbray exhibited at the last Council Meeting, the following plants in fine flower:—

Phalænopsis Schilleriana (2), *P. grandiflora* (2), *Dendrobium aggregatum* (2), *D. fimbriatum occulatum* (2), *Cœlogyne flaccida* (1), *Cypripedium venustum* (1), *C. concolor* (1), and *Gladiolus (Meyerbeer.)*

For *P. Schilleriana*, 15 marks were awarded, namely 10, the full number, and 5 extra, for their beauty and there being two. For *Cyprepedium concolor* 5 marks and for *C. venustum*, 3 marks.

Mr. A. Rogers exhibited at the same Meeting a Hyacinth and a Tulip, the latter with a very small flower, the former a tolerably good flower; also a double Portulaca.

Mr. Mowbray exhibited at this Meeting plants of *Dendrobium aureum pallidum*, from Tavoy, *Phalænopsis grandiflora* and *P. aurea ?*; and 10 pots of seedling Verbenas in excellent flower.

Three marks each were awarded for a blue and a dark red Verbena. No awards were made for the Orchids pending further enquiry.

Thursday, the 21st April 1870.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last General Meeting were read and confirmed.

The following were elected Ordinary Members:—

H. H. the Nawab Shah Jehan, Begum of Bhopal, Messrs. A Stewart, H. S. Clarke, Geo. S. Pearce, S. E Voigt, A. C. Pott, C. T. Inskipp, A. Phillips, T. J. Hay, T. Connell, F. Prestage, C. E. Price, Dr. Thos. Beaumont, and Capt. H. P. Lovell.

Lieut. J. F. Pogson a Corresponding Member, and Mr. Geo. Bartlett an Associate Member.

The names of the following gentlemen were submitted as candidates for election:—

C. E. Hudson, Esq., Talooka Pinjra, Azimghur,—proposed by Mr. A. J. Sturmer, seconded by the Secretary.

C. J. Wilkinson, Esq., Barrister at Law,—proposed by Mr. A. H. Mowbray, seconded by the President.

Mr. J. Hurst, Mussoorie,—proposed by Mr. R. H. Heseltine, seconded by the Secretary.

Capt. G. J. Scott, Supdt., I. G. S. N. Company,—proposed by the Secretary, seconded by the President.

John Moody, Esq., Raneegunge,—proposed by Mr. John Stalkartt, seconded by the Secretary.

W. P. Davis, Esq., Bengal Police, Midnapore,—proposed by Mr. A. R. Bainbridge, seconded by the President.

W. H. Cheetham, Esq., Merchant, Calcutta,—proposed by Mr. J. Gordon, seconded by the Secretary.

Major C. N. McMullin, Bengal Staff Corps, Umballa,—proposed by the Secretary, seconded by the President.

Rejoined.—Lieut.-Col., J. G. Forlong, R.E., Rajpootana, and J. H. Hutchison, Esq., Merchant, Calcutta.

The following contributions were announced:—

1.—Notes on the Botany and Agriculture of Malta and Sicily, by Dr. H. Cleghorn,—from the Author.

2.—Journal of the Asiatic Society of Bengal, Part 2, No. 1, 1870,—from the Society.

3.—Annual Report of the Agricultural and Horticultural Society of British Burmah for 1869,—from the Society.

4.—Records of the Geological Survey of India, Vol. 3., Part 1,—from Dr. Oldham.

5.—Progress Report of Forest Administration in Bengal for 1867-68,—from the Public Works Department.

6.—Correspondence regarding experimental Cotton Cultivation in Lower Bengal, —from A. Galstin, Esq.

7.—The Proceedings and Transactions of the Bethune Society from 1859 to 1869,—from the Rev. J. Long.

8.—Journal of the Royal Asiatic Society, Vol. 4, Part 2,—from the Society.

9.—Transactions of the Society of Agriculturists of France for 1869,—from Monsieur A. Jacquemin, on behalf of Monsieur Druyon de Lhuys.

10.—A small quantity (about two maunds) of Carolina Paddy,—from Board of Revenue.

The Secretary intimated that he had received applications for 60 maunds, but the Board have not been able to give more than the above quantity.

Colonel Wintle offered 5 maunds from the quantity of seed gathered by him last season at Dum Dum, which offer was accepted with thanks.

11.—Three seers of Kangra Poppy seed,—from the Deputy Commissioner.

The Secretary mentioned that he had a portion of this in hand for any one who would wish to try it, after meeting the application of Mr. Peppè of the Opium Agency, Chôta Nagpore, on whose account it had been obtained.

12.—Seed of *Inga Samun* from Ceylon,—from Major the Hon'ble E. R. Bourke.

The following is extract of Major Bourke's letter regarding this seed :—

"I have lately come up from Ceylon, and from a conversation which I had with Mr. Thwaites, Superintendent of the Botanical Gardens at Peradinya, respecting the difficulty that we experience in India in getting fuel for locomotive engines; and on enquiring of him whether he knew of any fast-growing hard-wood tree that was likely to prove useful in this way, he shewed me a tree then growing in the Peradinya Gardens and which was planted by him some 18 years ago, and a huge forest tree it is now.

"He was kind enough also to give me some seeds of the tree, and I take this opportunity of enclosing you a few of them for your use. He told me that in about 5 or 6 years it would grow up and be as thick as a man's thigh, or a cocoanut tree.

"If this is so, I think possibly it may deserve a trial, as it is a matter of great consequence to us in India."

13.—A small collection of tree seeds from the Eden Gardens,—from Capt. Chrichton.

14.—A further supply of Teak seed,—from J. A. Crawford, Esq.

(All the above seeds are available for distribution to Members and the Public generally.)

15.—Cocoons raised from eggs of the Japan silk moth, and from the Boroo Pooloo of Bengal (*Bombyx textor*),—from Mr. Cristoferis.

Floricultural Exhibition.

Read the following report from the Judges at the Flower Show held in the Society's rooms on the 7th April:—

The show was, altogether, a fair one considering the season of the year.

The collection of Orchids was very good.

There was a larger number of competitors than had been anticipated, consisting in all of eighteen. Of these, 9 were Members of the Society, and 9 non-Members. These latter, though they exhibited some good plants, were not entitled, under the Rules, to receive any marks.

Mr. Mowbray shewed the largest number of plants, *viz.*, 54 Orchids and about 45 other kinds, Vebernas, Caladia, &c. For Orchids in flower 87 marks were awarded; and for Orchids in bud, and not in flower, 52 marks for the rarer kinds—in all 139 marks. For miscellaneous plants, 25 marks, or a total of 164 marks.

From the Hon'ble Elphinstone Jackson's garden came the best collection of *Caladia*, some fine plants of *Coleus*, *Begonias* and *Geraniums*, and a few good plants of *Iresine Herbstii*; Perennial Phlox, and a few Orchids. Forty-one marks were awarded for all these.

Mr. J. A. Crawford exhibited the best collection (19 sorts) of Ferns, including a Lycopod *(Selaginella arborea)*; a few good Geraniums, a small collection of Orchids, Crotons and a few other plants. For the Ferns, Geraniums and Orchids, 23 marks were given.

The collection from the Dalhousie Square garden was mostly confined to Orchids, for which 18 marks were awarded, and 4 marks for Asters—in all 22 marks.

The Rajah Suttyanund Ghosal shewed a few good Orchids, including two fine plants of *Renanthera coccinea*, for which 10 marks were given; also 10 marks for 4 well grown climbing plants of *Bugainvillea glabra*, *Cissus discolor*, *Rhyncospermum jasminoides*, and *Antigonon leptopus*—or 20 marks in all.

From Mr. C. E. Price's garden came the best collection (20) of Geraniums (including the "Ivy-leaved") for which 10 marks were given. Mr. Price also shewed some well grown *Antirrhinums*, and a few pots of *Portulacas*.

Mr. W. Ter Veen exhibited a fine healthy plant of the Irish Ivy, to which 10 marks were awarded.

Mr. W. Stalkartt, submitted several pots of Pinks, double Portulacas, Phlox and Verbenas; among the latter two fine plants of the striped variety, for which 5 marks were given.

Mr. Archibald Rogers sent in a healthy plant of *Clianthus Dampierii* not yet in flower, and 2 or 3 other plants.

The Royal Botanical Gardens contributed an excellent collection of plants (120 in all) consisting of Orchids, Ferns, (S. American and Sikkim) Palms, Coleus (Indian and Javan), Aroids, Begonias, Iresines, and other handsome foliaged plants.

Among the non-Members, Mr. W. C. Wood exhibited a fine collection (10) of Geraniums; Mr. P. A. Collins some good Geraniums and a few Begonias, and Mr. G. Livesay, (7) fine Orchids in full flower, including *Phalænopsis grandiflora* and *Renanthera arachnites*.

Mr. Must, Apothecary, H. M's 96th Regiment, shewed a small collection of Vegetables raised in the Hospital garden at Dum-Dum under his direction, consisting of Red Cabbage, Knole-Kole, Turnips, Carrots, Celery, Beet, Lettuce, Squash and Tomatoes, to which honorable mention was accorded.

A list, in detail, of plants exhibited and marks awarded, is annexed.

JOHN SCOTT.
G. W. BARTLETT.
A. H. BLECHYNDEN.

CALCUTTA, 8th April, 1870.

CULTIVATION OF SILK IN INDIA.

The Secretary submitted the following remarks from Capt. Hutton, F.G.S., in reply to Mr. Cope's observations, introduced in last month's Proceedings, regarding his (Capt. Hutton's) paper on Silk Cultivation in India published in a recent number of the Society's Journal:—

"With reference to Mr. Cope's remarks on my "*stubborn facts.*" as contained in that gentleman's letter lately published in the Proceedings of the Society for the 16th of March, I would request the favor of your permitting me to offer a few observations, inasmuch as it appears to me that so far from refuting my views, Mr. Cope has completely upheld and confirmed them. He should have remembered that my remarks on the cultivation of Silk in India, and especially in the Punjab, were *general*, and as such are fully borne out by facts, for indeed few things could more clearly prove my general correctness than Mr. Cope's acknowledgment that '*the experiments made at Lahore and Umritsir, were not such as to warrant the commencement of operations in those localities on a large scale, or such as would warrant any English capitalists in laying out a considerable sum with the view of enlarging silk cultivation in Upper India.*"

"Now one of two things is here evident, namely, either that the experiment was sufficiently successful to *warrant* the further outlay of capital on an extensive scale, or it was so completely a failure as to induce its most strenuous upholders to warn the speculator off the ground, and recommend him to prosecute the experiment no further. This is not the course that success would have recommended, but that which common sense and prudence, in the absence of success, would surely point out as the most judicious course. Had the Punjab exhibited any signs of eventually becoming a good Sericultural Province, Mr. Cope would have been the very first to belaud it, but the caution he gives, is quite sufficient to show that he, at least, thinks it possible there might be danger a-head. If the speculation succeeded so well as to yield a return of 17 per cent, it is difficult to perceive for what reason the caution has been put forth, while at the same time it is just as difficult to perceive how there could have been such return when Mr. Turnbull, a trustworthy and experienced Superintendent

of Filatures, declared the cocoons sent to him from the Punjab to have deteriorated 56 per cent below the standard of Cashmere, as furnished by Mr. Cope himself only two years previously.

"At the time of the experiment it was reported that Mr. Cope had received considerable aid from Government in money and other matters, and if after *the re-payment* of these advances there was still a profit of 17 per cent, one would imagine the prospect to be fair enough; but, on the other hand, if the advances were not re-paid then the profit becomes altogether fictitious. Into these matters, however, I have no wish to enter a step further, it being quite sufficient for my purpose that Mr. Cope cannot recommend a continuance of the experiment.

"I would wish it to be borne in mind that while in my 'Remarks,' I have not hesitated to record my opinions, yet that I can put forth no claim whatever to infallibility: those remarks I believe to be founded on facts and every man has of course a right to give an opinion, provided he possesses any knowledge of the subject in hand, and no one would be more rejoiced than I were Mr. Cope to succeed in proving me wrong.

"With regard to Goordaspore, however, if Mr. Cope has been able to come at 'the truth, the whole truth, and nothing but the truth' (often in these cases a very difficult matter), there may possibly be something exceptional in its climate so as to enable it to stand out like a smiling *oasis* amidst the surrounding waste. The accounts now given, however, of the flourishing condition of the Silkworm in this small Paradise, where 'increased Mulberry cultivation brought an augmentation of produce without any diminution of proportionate profit, or any deterioration in the worm,' where, in short 'the operations which have been enlarged to a very considerable extent during the last few years, are far beyond the range of mere experiments, have proved beyond the possibility of a doubt by the quality of the silk produced, and *by the continued healthiness of the worms, never supplemented by new importations of eggs from without*, that silkworms can be successfully and profitably reared outside, though at no great distance from the foot of the Himalaya mountains.'

"Now, unfortunately for my opponents, I possess rather a retentive memory, especially upon subjects in which I have been much interested, so that upon reading this flaming account of success, it at once occurred to me that I had read some time ago a very different account of what could be done by this same successful Sericulturist. Accordingly, referring back to some old pamphlets, I soon discovered that in the outset, so little dependence did Mr. Cope place in the climate of the Punjab, that he actually proposed, in order to preserve the eggs of his *Bombyx Mori*, to send them *from the Punjab up to the Mountain Station of Durrumsala!*

"Here is a clear and tangible proof that it was not then expected that the insects could be properly acclimatized in the Punjab, and the subsequent failures proved the truth of the doubts then entertained. With reference to Jaffir Ali, it was at the same time declared that he 'invariably preserved his eggs in a cool

nder ground chamber, or *tykhana.*' Why was this done? simply because the climate of the Punjab was found to be altogether *murderous* to these northern worms! It is evident then from this, that the heat of such a climate is far greater than the eggs can bear, and if it be inimical and destructive to the egg, it will undoubtedly be equally so to the insect in every other stage. Indeed, as above stated, Mr. C. S. Turnbull, to whom cocoons from Oudh and Umritsur were submitted, stated that they had degenerated 56 per cent below the standard of Cashmere, as furnished by Mr. Cope only two years before. The loss annually sustained by Jaffir Ali Khan, even when the eggs were kept *in the tykhana.* is said to have been 'from a fourth to a third,' the heat (even under ground) drying up the eggs without hatching them.*

"If this can be called successful acclimatisation, then no one need despair! Which of these statements, however, are we to believe? The former or the present one? For as they stand they are in direct opposition to each other; and if the latter is to be accepted, then must the climate have undergone some startling and very beneficial changes since 1862; for in those days the loss from 'one-fourth to one-third' must either have speedily put an end to the experiment, or *necessitated the annual importation of fresh stock.*

"Truly, then, I do not perceive that Mr. Cope's battery has done much damage to my '*stubborn facts,*' and consequently still maintain the views put forth in my recent pamphlet on 'The Cultivation of Silk in India.' "

EXPERIMENTAL TRIALS WITH JAPANESE SILK WORMS IN BENGAL.

Read a letter from Mr. G. De Cristoferis, descriptive of an experiment to rear Japanese Silk Worms at Gadee, *viâ* Jungypore. (See Correspondence and Selections in this Number.)

MISCELLANEOUS COMMUNICATIONS.

1.—From Baron A. Baranowsky, dated 14th April, tendering his best acknowledgments for the prompt assistance rendered him in his enquiries regarding various Indian products in the shape of fibres, silk, cotton, &c., and for a collection of seeds, specimens of sorts, and publications of the Society; all which will aid him in his endeavours towards establishing scientific and commercial relations between the East Indies and Russia. The Baron promises to reciprocate in connection with the Agricultural Societies of Russia.

2.—From Major W. C. McDougall, Deputy Superintendent, Central Stud, acknowledging receipt of a packet of Brazilian grass seed (*Panicum spectabile*) which he has made over to the Koruntadhee Stud Depôt and requesting further supplies for the Ghazeepore and Buxar Depôts. Every care will be taken of this seed, and a report supplied as to the result of its culture in these Depôts.

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* Hutton on the Restoration of the Silk worm, Part 1.

Ibid—and "Powlett's Report in Proceedings, Agricultural, and Horticultural Society of India,"—9th July 1862.

The Secretary intimated he had immediately complied with this request. About 10 packets had already been distributed to various parts of the country, and he had still a small quantity remaining to meet the demand of any other persons desirous of introducing this valuable grass.

3.—From E. C. Bayley, Esq., Secretary to Government of India, applying, on behalf of the Government of Madras, for 50 pounds of Rapeseed for experimental cultivation.—Steps have been taken to meet this requisition.

4.—From the Deputy Commissioner of Seonee, applying for cuttings or plants of Rheea for the use of the Local Fund Committee, who are desirous of making an experiment with a view of introducing the cultivation of this valuable fibre-yielder into that district.

The Secretary stated he had been under the necessity of replying to this—of which many similar applications were constantly being received—to the effect that since the resumption by Government of the Society's garden, they had not been in a position to meet them.

5.—From H. Rivett-Carnac, Esq., Cotton Commissioner, applying for certain kinds of seeds for trial at certain cotton seeds farms established in the Central Provinces and the Berars.

6.—From Captain H. P. Lovell, Superintendent, P. & O. Company, agreeing to allow the Society one ton annually, free of freight, for seeds indented for from Australia.

7.—Form John Scott, Esq., presenting, on behalf of Mr. Stirling, a paper on the Roses in cultivation in the Royal Botanical Garden. (Transferred for publication in the Journal.)

In connection with the Report of the Judges on the recent Show, it was moved by Baboo Peary Chand Mittra, seconded by Dr. Tonnerre, and resolved—

"That the Council be requested to consider the Rules for the Monthly Exhibitions and report on them."

Mr. Mowbray submitted a plant of *Dendrobium formosum*, for which 4 marks were awarded, and a very fine example of *Ærides affine*, to which 6 marks were given.

Thursday, the 19th of May, 1870.

Baboo Peary Chand Mittra, V.P., *in the Chair.*

Read a letter of apology from the President for not being able to attend.

The Proceedings of the last General Meeting were read and confirmed.

The following gentlemen were elected Members:—Messrs. C. E. Hudson, C. J. Wilkinson, J. Hurst, John Moody, W. P. Davis, W. H. Cheetham, Captain G. J. Scott, and Major C. N. McMullin.

The names of the following gentlemen were submitted as candidates for election:—

Lalla Lushminarain, Zemindar, Bareilly,—proposed by Mr. George Benson,

R. B. Pringle, Esq., Badalipar Tea Garden, Assam,—proposed by Mr. H. H. Sutherland,

J. Ward, Esq., Chief Accountant, E. B. Railway,—proposed by Mr. J. M. Brandis,

Captain J. H. Willoughby-Osborne, Revenue Survey,—proposed by Mr. W. G. Wagentrieber,

Robert Roberts, Esq., Chief Auditor, E. I. Railway,—proposed by Mr. Cecil Stephenson,

Meer Shahamut Alli Khan, Bahadoor, Superintendent of Rutteeana,

The above were seconded by the Secretary.

The following contributions were announced :—

1.—First Annual Report of the Sanitary Commission for Bengal for 1868, (2 copies)—from the Government of Bengal.

2.—Progress Report of Forest Administration in Oude for 1868-69, and of British Burmah for 1867-68,—from the P. W. Department.

3.—Annual Report for 1869 of the Cape of Good Hope Agricultural Society,—from the Society,

4.—Journal of the Asiatic Society of Bengal, Part 1, No. 1, 1870,—from the Society.

5.—Report for 1869-70 on the Khoosroo Bagh at Allahabad, by S. Jennings, Esq.,—from the Author.

6.—A large supply of double Zinnia seed,—from C. E. Blechynden, Esq.

7.—Seed of a *Dodonæa* (*dioeca ?*),—from S. Jennings, Esq.

"This plant"—writes Mr. Jennings—"is a native of the Punjab, and is becoming a favorite in the N. W. Provinces on account of its brilliant light green shining leaves, fresh in the dryest and hotest weather. It will quite supersede the old fashioned '*Mehndee.*' To make the hedge sow the seed in a nursery, pick out the plants when 3 or 4 inches high and plants them in a double row 6 inches to a foot apart. They should have plenty of water when young, and not be over-clipped until over 4 feet in height. They may then be treated like *Mehndee* and trimmed to shape."

8.—Seed of *Disemma coccinea*,—from R. W. King, Esq.

Mr. King is doubtful whether this creeper will grow in the climate of Calcutta, but the seed he sends being gathered from an acclimatized plant raised at Ranchee in Chôta Nagpore, may possibly come to something. "It is a pretty creeper" —adds Mr. King—"but will not stand the sun like most of the passion-flower tribe; the flowers do not last long, but it is worth growing."

Mr. Scott, Curator of the Botanic Garden, says he raised this plant repeatedly from *imported* seed, but never succeeded in keeping any of the seedlings over the hot season. He hopes, however, for better success from *acclimatized* seed.

9.—A small collection of seeds of ornamental trees,—from Mr. George Bartlett.

10.—A few kinds of seeds of ornamental trees,—from the Maharajah of Burdwan.

11.—Seeds of *Poinciana regia*,—from A. Courjon, Esq.

12.—A sample of Indian Rubber from Cooch Behar,—from Col. J. C. Haughton.

Colonel Haughton sends this caoutchouc with the view of ascertaining whether it is marketable and its probable value in Calcutta. Mr. Linzie of Messrs. Lewis Bailey & Co., values it at from Rs. 45 to 50 per bazar maund, it being of the first quality.—" So fine a grade is rarely seen in the bazar, and I have no doubt that a lot similar to sample would meet with ready sale."

AUSTRALIAN FIELD SEEDS.

Submitted a useful report, dated 2nd May, from Mr. F. Halsey, of Umritsur, on the Australian Field Seeds received by him from the Society in October last. *See Correspondence and Selections.* (It would be very desirable if other recipients would follow Mr. Halsey's example. Every applicant for these Australian field seed received a similar printed list, with a request to favor the Society with an impartial report on the result of their sowings, and as to the kind best adapted for cultivation in their respective districts.)

IMPROVEMENT OF SEED BY SELECTION.

Read a communication from Mr. J. G. Robertson, Assistant Settlement Officer, dated Meerut, 16th May, on the above subject, and submitted the specimen of wheat therein referred to. *See Correspondence and Selections.*

SUGGESTION FOR THE INTRODUCTION OF FRUIT TREES WITH ORNAMENTAL BLOSSOMS INTO FLOWER GARDENS.

The Secretary submitted a letter from Mr. Henry Cope, dated from Tours in France, on the culture of handsome flowering fruit trees. *See Correspondence and Selection.*

FLORAL NOTES.

Extracts from several letters regarding ornamental plants were next read :—

Mr. Grote writing from London, 24th March, observes,—" We had some good Orchids at the Kensington Show last week. *Vanda cærulescens* from Burmah will be a great favorite. Some of the prettiest accession to our Orchid collections have come from Burmah * * * * Schiller's *Phalænopsis* has been prominent at our late exhibitions. One of our common *Cœlogynes* too was in great show at the last, C. *cristata*; the yellow variety of *Dendrobium Farmerii* is a magnificent thing."

Dr. Thomas Anderson, in a letter dated London 15th April, remarks :—

"I went to one of the Horticultural Society's exhibitions a day or two ago. I was much pleased with the magnificent show of *Azaleas* and *Rhododendrons*. The orchids were good but there were not many of them. Among Asiatic ones, which we see oftenest in Calcutta, were a splendid block of *Dendrobium Jenkinsii*, *Phalænopsis Schilleriana* with a panicle of flowers about 4 feet long and covered with bloom ; some very fine *Cypripedium*, and a good show of *Dendrobium nobile*. All these plants though well grown had flowers far inferior in colour to

what we see in Calcutta. There is a great rage for palms for decorating tables and rooms. None are prettier than young *Calami*, *Livistonas* and *Chamærops*, and our dinner tables in Calcutta, and drawing-rooms too, might often be graced by a few pots of such palms."

Mr. Samuel Jennings, writing from Allahabad, 29th April, observes :—

"You remember how I used to be plagued with the attacks of crickets and cockroaches on my Orchids. Nothing of the kind has happened here—every flower duly opens, and every root is perfect and uninjured. I have adopted a new method of mounting the smaller orchids, which is a vast improvement on our old clumsy fashion of attaching them to hugh blocks of mangowood. I use teak-wood boards about 18-inch by 9 and ¼ of an inch thick, the plant is attached to the centre of the board—protected with moss, by copper wire and tacks in the usual way; the whole concern is light and neat, and hangs close against a wall like a picture, and the root seems to adhere quite closely to the smooth surface. A great advantage of this plan is, that there is no danger of injury by white ants. I have *Phalænopsis*, *Dendrobes*, and *Ærides* mounted in this manner, which, when in flower, make pretty drawing-room ornaments, weighing not more than a few ounces.

"I have now Moss grown in the same manner, but on large planks, 5 to 6 feet long, covered with hill fern and small orchids, &c. &c., in perfect health, the Moss itself growing as it never grows in Calcutta.

"Amongst the novelties I have at present are three beautiful Begonias. :—

1. *Begonia Boliviense*, a new variety, with a delicate narrow shining leaf, the flowers are brilliant scarlet, something in the way of a fuschia of large size. It is a splendid plant.

2. *Begonia* "Princess Charlotte," a very fine variety of *Begonia Rex*, leaves large and hairy, under side green with prominent red veins, upper surface bands of chocolate and silver.

3. *Begonia* "Mr. Stuart Low," a pretty variety with a roundish leaf, French grey spotted thickly with white.

"Some of the blush Geraniums are also very beautiful and vastly admired, but I fear they will not live, though now in fine condition, the newer leaves are already turning yellow, though no *rot* is yet apparent. I have applied powdered sulphur. What would you do to save them ?

"Of Roses I have managed to save a few new varieties, "Miss Ingram," "Duke of Edinburgh," "Baroness Rothschild," and "Clothilde Rolland." One or two Orchids have flowered which were new to me. *Dendrobium eburneum*, with a pure waxy white flower, crisp lip with a bright scarlet stain down the centre; a very lovely *Phalænopsis* in the way of "*rosea*" but I think larger pink sepals and petals, crimson lip with a slight blush stain upon it, and *Oncidium guttatum*, a very good species with a greenish flower spotted with red. I do not know if you are acquainted with it. Another plant I might name which I never could

keep in Calcutta, is here in most vigorous condition, I mean *Pleione maculata* a native of very high hills and a cold pure air.

"I have also succeeded in raising from seed two new Australian Casurinas several Acacias, Gums, &c., *Swansonia*, a creeper now in flower, and the splendid *Clianthus Dampieri*, which Mr. Warwick of Cawnpore has flowered. It failed with me."

The Secretary stated that Mr. Scott, Curator of the Royal Botanic Garden, had obliged him with the following remarks in respect to Mr. Jennings' letter:—

"I am glad to see that Mr. Jennings is managing his orchids and other things so well. I hope it may be a permanent success: though I much fear its being so with such things as *moss*, and the little tiny hill ferns which grow amongst it. I have often had these in fine order from the hills in the cold weather, and they were all that could be desired until the hot season, when nearly one and all went off. The mode which he adopts for orchids is that practised generally by European Nurserymen, and of course looks much neater than that in vogue here. The *Begonias* are I believe new to India. No doubt it is the heat alone which is causing the discolouring of his geranium leaves, and for which of course applications of sulphur will do nothing. The only hope is in cooler quarters; they should also be watered sparingly, merely enough to keep their leaves from 'flagging,' exciting the least possible growth. I do not think the *Oncidium guttatum* has yet been flowered in Calcutta. *Dendrobium eburneum* has. I have *Pleione maculata* and other species even now in fair order, but I am by no means sure of so keeping them until next cold weather. Just now they are manageable, the high temperature with the saturated atmosphere of the rains is the trying time for them here."

Mr. R. W. King of Ranchi (Chôta Nagpore) reports that he has succeeded most satisfactorily in raising double *Portulacas*:—"This is the second season of growing the double ones, and I think them so much more beautiful than the single, that I shall never grow the latter again. I will save some seed for you."

Miscellaneous Communications.

1.—From Secretary, Government of Bengal, enclosing copy of letter from Officiating Superintendent, Royal Botanic Gardens, with a few small samples of Cotton collected in the small experimental cultivation being carried out in the Garden.

2.—From the same, conveying the thanks of the Lieut.-Governor for the eggs of *Bombyx textor*, forwarded to the Acclimatization Society of New South Wales, Sydney.

3.—From H. Rivett-Carnac, Esq., Cotton Commissioner, requesting, with reference to his previous application, submitted at the last Meeting, that the seeds may be forwarded to the Assistant Cotton Commissioners at Akola, Oomraottee, and Hingunghat.—Complied with.

4.—From the Secretary, Cape of Good Hope Agricultural Society, returning thanks for Part 4, Vol. 1 (New Series) of the Society's Journal. Mr. Holding writes as follows :—

"I hope, that my last letter per Steamer "Chiltern," together with the samples of Cape silk, will have intimated our anxiety to acknowledge your kind efforts to meet our wishes respecting Silk, &c. The lady to whom I then alluded as having been sent to Europe by the Government to acquire the art of reeling has just returned with certificates of her proficiency in all branches of sericiculture, and as soon I can procure some skeins of silk reeled by the new machinery which she has brought with her they shall be forwarded by the earliest opportunity to Calcutta. Accept our best thanks for vol. I part IV. (New Series) which is a most interesting addition to the other volumes, that have proved in many instances most valuable as works of reference on certain subjects in connection with new industrial products. We have had, I am happy to add, no sickness this year amongst the worms from European seed; and should we be fortunate enough to receive a favorable report of the eggs which were sent to the European market in February, we shall probably be able to establish a new branch of industry and one far more remunerative to the colonists than the exportation of either cocoons, or silk in skeins." (Mr. Holding's previous letter and report on samples of silk were submitted at the Monthly Meeting in February last.)

5.—From Mr. Geo. Bartlett, conveying his acknowledgments for his election as an Associate Member of the Society.

6.—From Lieut. J. F. Pogson, returning thanks for his election as a Corresponding Member. Mr. Pogson also offers a few remarks in reference to the important subject of food for cattle :—

"The question of Cattle fodder has engaged my attention for some time. From Government elephants to plough cattle, starvation seems to be the order of the day, and it appears to me that unless some new kind of fodder is introduced, things will go from bad to worse. If I may believe all I hear, the 'Bromus Schraderi' or 'Australian Prairie Grass,' is just the thing suited for India. It grows to 3 feet in height and more, and would be first rate cattle food and elephant fodder, and as the heavy mortality amongst Government elephants is ascribed to want of *quantum suff* of proper green food, the introduction of this grass would perhaps put an end to it.

"The Society could get the seed direct from Australia at a cheap rate, though 35 lbs. per acre seems a lot to sow.

"I should also like to see summer and winter Tares tried in this country. That the Tare was cultivated in the Holy Land, even during the time of our Lord and Saviour, is proved by Holy Writ. But the Tare has not travelled towards India, and perhaps has died out in Palestine. Be that as it may, the future wants of India include food for Cattle, and modern science tells us that it is much cheaper to grow cattle food than to trust to Providence to provide a

gratuitous supply. Besides this, the day is coming when every acre of good land will be made to produce its full value, and the sooner the lazy and apathetic men of the county learn that cattle have their '*Rights*' as well as their proprietors the better."

The "Prairie Grass" and Tare referred to by Mr. Pogson have been imported for the last 4 or 5 years by the Society with the collection of Australian field seeds, and widely distributed over the country. (See Mr. Halsey's report, *ante.*)

7.—From Messrs. Vilmorin, Andrieux & Co., of Paris, intimating the dispatch from Bordeaux per *Imperatrice Eugénie* of the consignment of seeds—vegetable and flower—ordered by the Society.

8.—From Messrs. D. Landreth and Son of Philadelphia, enclosing invoice of seeds which they are about forwarding *viâ* Liverpool, in virtue of the Society's order.

For the above communications and contributions the best thank of the Society were accorded.

Thursday, the 24th of June, 1870.

J. A. Crawford, Esq., President, *in the Chair.*

The Proceedings of the last General Meeting were read and confirmed.

The following gentlemen were elected Members:—

Lalla Lushminarian, Captain J. H. Willoughby-Osborne, Messrs. R. B. Pringle, L. Ward, Robert Roberts, and Meer Shahamut Alli Khan Bahadoor.

The names of the following gentlemen were submitted as candidates for election:—

Colonel S. Becher, Commanding troops at Delhi,—proposed by Mr. Andrew Stirling, seconded by Mr. Pigott.

Dr. R. A. Barker, Civil Surgeon, Serampore,—proposed by Mr. B. J. Yate, seconded by the Secretary.

D. W. Campbell, Esq., Locomotive Superintendent, E. I. Railway, Jamalpore,—proposed by Mr. Allan Stokes, seconded by Mr. H. Carrick.

D. G. Herklots, Esq., Agriculturist,—proposed by Colonel E. H. C. Wintle, seconded by the Secretary.

Baboo Punchanana Mittra, Calcutta,—proposed by Baboo Protap Chunder Ghose, seconded by Baboo P. C. Mittra.

Manager of Raj Shewhur, Tirhoot,—proposed by the Secretary, seconded by Mr. Crawford.

Mr. J. A. Gregory, Calcutta,—proposed by Baboo P. C. Mittra, seconded by Baboo P. C. Ghose.

Dr. Howard, Civil Surgeon, Oomraottee,—proposed by Major W. Nembhard, seconded by the Secretary.

Wm. Bull, Esq., Resident Engineer, Oude Railway Company, Lucknow,—proposed by Mr. C. Chambers, seconded by Mr. H. Carrick.

F. S. M. Riach, Esq., Rosekandy, Cachar,—proposed by Mr. B. D. Colvin, seconded by the President.

President, Municipal Committee, Allyghur,—proposed by the Secretary, seconded by the President.

H. Robarts, Esq., Indigo Planter, Bellah, Allyghur,—proposed by Mr. J. Gordon, seconded by Sir John Wemyss, Bart.

S. Creswell, Esq., Calcutta,—proposed by Mr. M. Henderson, seconded by Mr. W. Pigott.

E. Buck, Esq., c.s., Furruckabad,—proposed by the Secretary, seconded by Mr. Crawford.

Rejoined—F. S. Growse, Esq., c.s., Muttra.

The following contributions were announced:—

1.—How to develope productive industry in India and the East; by P. R. Cola,—from the Author.

2.—Report of the Bombay Chamber of Commerce for 1868-69,—from the Chamber.

3.—India as a source of Cotton supply; by Isaac Watts, Secretary, Cotton Supply Association,—from the Author.

4.—Records of the Geological Survey of India, Part 2, Vol. iii., May 1870,—from Dr. Oldham.

5.—Ditto, Parts 1 & 2, Vol. iii.,—from Government of Bengal.

6.—Journal of the Asiatic Society of Bengal, Part 2, No. 2, 1870,—from the Society.

7.—Seed of the Black Opium Poppy,—from Dr. J. D. Hooker.

8.—A small sample of wheat,—from Mr. J. A. Sturmer.

9.—A sample of raw flax from Purneah,—from Mr. P. Burke.

10.—A small sample of Nankin raw Cotton, and Cloth made therefrom at the Central Jail at Nagpore,—from Dr. John Brake, Inspector-General of Jails, C.P.

11.—Gum of the "Coortah" tree of Cachar,—from Mr. C. Brownlow.

WHEAT.

The Secretary announced that he had distributed the small quantity of the fine wheat, raised at Meerut by Mr. J. G. Robertson, presented at the last Meeting, to Messrs. Bridgman (Goruckpore), Sturmer (Ghazeepore), Halsey (Umritsur), Jennings (Allahabad), Capt. Farquhar (Poosa, Stud) and Colonel Wintle (Dum-Dum), who had all promised to give it their best attention, and report the result in due course. Mr. Bridgman, who has for many years been much interested in the introduction of good descriptions of cereals and grasses, writes as follows on the subject of the above mentioned grain and on wheat generally:—

"I have to thank you for your obliging letter of the 28th May, and the

report which accompanied it. I shall be very glad to have a small quantity of Mr. Robertson's wheat seed to experiment with. As his fine seed has been produced by very high cultivation, I rather fear that on being submitted to ordinary cultivation it will revert at once to ordinary seed. The thing which it is desirable to discover is, it appears to me, a variety of country wheat, the accidental product of nature, of which the qualities shall excel those of ordinary wheat, especially in abundance of produce. With that view, at harvest time in the spring, I sent notice to my tenants to bring to me all the ears they could select when reaping their wheat, of which the length, exclusive of the beard, should be 5 fingers or 3½ inches. For such ears I paid them half a pice each, and for ears of 6 fingers (4½ inches) I offered them 2 pice each. I obtained but few of the latter, but of the former I have got a goodly quantity. I propose to sow them both separately in my own ground next season; and from each I have selected the largest grains to be sown apart from the rest. I do not propose to subject them to exceptional cultivation, because I think that might lead to fallacious results, and defeat the object I have in view. It is, of course, of much importance to prove to native agriculturists the pecuniary benefits of high and careful cultivation. This Mr. Robertson's experiment does very fully. But in this part of the country the introduction of an improved system of cultivation would be a slow process if attended by much additional labour. They are better satisfied with a small crop produced by little labour, than a large one which costs them much trouble. There are occasional exceptions, however, to this character, through whom an improved system may be gradually introduced, and I shall not lose sight of the result of Mr. Robertson's experiment. To give, however, seven waterings to a wheat crop, would not be practicable on a large scale to any cultivator, however enterprising and industrious he might be."

Mr. A. J. Sturmer (writing from Ghazeepore) acknowledging the receipt of Mr. Robertson's wheat, takes the opportunity of sending a small sample of wheat raised from Australian stock, supplied him by the Society three years ago. "The first year"—observes Mr. Sturmer—"the produce did not come up to the seed sown; the second year rust attacked it; the third year (last) I got about 8 maunds to the beegah. If you would like any for distribution, I shall with pleasure send the Society a maund or two. What do you think the price of such wheat would be in Calcutta?"

Baboo Peary Chand Mittra said that this wheat is a good description similar, but superior, to "Doodeea," though rather small in the grain, value rupees 3-4 per maund, or perhaps a little more if equal to sample.

Brazilian Grass.

The Secretary mentioned that although he had distributed the Brazilian grass seed (*Panicum spectabile*) received from Dr. Hooker in December last, to upwards of 50 applicants, the demand had been so much greater than the supply that he

had been obliged to solicit that gentleman's kind offices for a further quantity. Amongst others who had applied, were the Collector of Kandeish for the Model Farm at that station, and Major Woodcock, in charge of the Government Garden at Lingsoogur, in the Deccan, who both required large quantities. Mr. Bridgman reports that he has two plants now raised; "I may therefore hope that more will grow when the remaining seeds are sown at the beginning of the rains; but these two will, I trust, be sufficient to secure to me this valuable plant." The Secretary added that if those who succeeded in raising this grass would remember to send seed to the Society in due course we should soon be independent of any further importations, and a most valuable grass be thus generally introduced throughout India.

Gum of the "Coortah" Tree of Cachar.

The Secretary next read the following letter from Mr. Charles Brownlow of Cachar in respect to the above Gum:—

"I have just forwarded a larger sample of the gum of the "Coortah," *Sapotaceæ.* This tree is called by the Calcutta coolies here the Jungly Mhowah. The flowers are smaller and not so fleshy, nor so sweet as its cultivated congener, but they are pleasant to the taste and would probably yield spirits if distilled. My particular object in sending the sample of gum is to ascertain its probable value for telegraph cable and other purposes, and I hope the quantity will prove sufficient for experiment. A sample I sent you a couple of years ago (in June 1866), was altogether too small for the purpose.

"I am well assured that if this gum fetches anything like the price of Gutta Percha, the quantity the district could produce would be very much greater than that of India Rubber, because the tree occurs in large numbers (very much larger than India Rubber) in all virgin forest lands.

"The mode of tapping is somewhat different: the gum does not consolidate into leaves on issuing as the India Rubber, and Bamboo joints must therefore be placed under the grooves cut in the bark; these gradually fill and are emptied into a larger vessel, the milk is then boiled or else dried in the sun to a proper consistency. Coortah timber figures largely in the local timber market; it is a second-rate wood, with a pink or red heart, and white sap wood, which soon rots out of doors and on the ground."

It was agreed to send this gum to Dr. Forbes Watson of the India Museum for report on its quality and applicability for purposes for which Gutta Percha and Caoutchouc are employed.

Flax.

Mr. P. Burke of Purneah in forwarding the sample of raw flax referred to under the head of contributions, writes regarding it as follows:—

"My object in sending the fibre is to ascertain its market value, and if it would find sale in Calcutta.

"At present linseed is grown for the seed alone, and the stalks from which the fibre is extracted is burned or thrown away; if all this waste could be turned into fibre for the English market at rates sufficient to pay for its extraction, and the trouble of collecting and investing money, it would be so much money added to the resources of the district, as well as affording profitable occupation to hands that are not now used in field-labour; and all this without any extra outlay in cultivating the linseed, for the seed pays for the expense of cultivating as well as leaving a small profit."

Mr. W. Stalkart remarked that though short in length this flax is of good strength, and would be very serviceable for canvas making, and if kept up to quality in large quantity would be worth Rs. 8 a maund.

Cotton.

The next subject that came under consideration was the sample of raw Nankin Cotton, and cloth made from it in the Nagpore Central Jail. Dr. Brake states, he believes the seed was originally obtained from the Society, and now the whole process from sowing the seed to making garments from the cloth is conducted within the jail-walls. "At present" (adds Dr. Brake) "the demand for Nankin cloth exceeds the supply, but I am having a large stock of land in and near the jail sown, and have forwarded a small quantity of seed to Puchmurree, a hill-station in these provinces, now under trial as a Sanatarium."

This cotton is of good quality, and the cloth was admired by the Members present for its great strength. Dr. Brake was requested to send a larger piece for a fair examination and report.

In connection with the above, the Secretary read the following extract of a letter from Mr. Burke :—

"Some years ago I addressed you on the subject of Cotton cultivation, and have ever since made trials directly or indirectly, as well as observations on the subject, with the same result—*viz.*, the plant grows luxuriantly, gives a very heavy yield of good Cotton (2 to 300 pods to a plant), but nearly all the pods were destroyed by a small caterpillar. I had the diseased pods bottled up, and ascertained the kind of pest we had to deal with, but could hit on no remedy.

"I am going to make another trial this year on long-stapled acclimatized seed procured in the district."

Culture of Potatos in Furruckabad.

Mr. Buck, Settlement Officer at Furruckabad, expresses a wish for any infortmation on the following subject, and will be obliged to any member of the Society who can give it :—

"Potatos are *extensively* grown in the vicinity of Furruckabad. The ground is loaded with the coarsest manure, often the produce of latrines. The amounper acre is often from 300 to 400 bullock-loads. Potatos, are grown every other

year with tobacco and 'mukka' intervening. The result is that of late years the potatos have deteriorated and (in consequence probably of over-manuring) are universally diseased, deficient in flavour, and appear wanting in starch. Would not bone-manure be beneficial? If so, in what way should it be prepared. The cultivators who grow potatos are generally *Kachies*, the most intelligent and painstaking class in the North-West, who would spare neither labour nor expense if they could profit thereby; as it is, they frequently spend as much as 20 rupees per acre for manure alone. Some of them have tried Saltpetre and Indigo seed in addition to the coarser manure, and the former has certainly been a partial success. Any information on the subject will be acceptable as to the proper treatment of the soil for potatos."

Silk.

In his communication on the subject of Cotton, Mr. Burke offers the following remarks as to the cultivation of Silk in Purneah:—

"About 6 years ago I made a trial on Silk. I imported diseased worms from Maldah, the fly crysalis was brought in the silk cocoon. I had the worms fed on uncultivated mulberry of all kinds, as I had no mulberry cultivation from March until June. The cocoons increased 25 per cent. in weight. I cut the worms out of 100 of the imported cocoons, and the same number out of the acclimated cocoons, and found the last to have increased in weight; but during the rains, for want of proper food, they fell off to the original weight, but improved with the dry season. As it rained very heavily and incessantly during that season, and the supply of food was very precarious, many of the worms died, but the greater portion recovered on the weather clearing up. The fly, which was imported with the silk-worm from Malda, attacked the worm in its 3rd or 4th generation, and destroyed a good many worms; but I had the diseased worms bottled up, and discovered the kind of fly which caused so much damage. A remedy was easily devised by throwing a cover over the worms that would keep out the fly; but as I had no plantation of mulberry trees, I had to abandon the experiment with the intention of resuming it as soon as I could get up a small plantation.

"The whole of this district is perfectly well-adapted to the rearing of the silk-worm. The mulberry grows without care, and the worm thrives as well as in the neighbouring district of Malda. It only requires a little money and a supply of good mulberry, with a batch of good cocoons.

"Any information, &c., required about this part of the country will be given, and I would not mind helping to start a silk factory, or join in one if necessary, if the necessary plants or seeds could be secured."

In connection with the above the Secretary submitted two letters from Dr. Bennett, Honorary Secretary of the Acclimatization Society of N. S. Wales at Sydney. The first acknowledging the safe receipt of eggs of the annual

silkworm ("Boro Pooloo") *Bombyx textor*, and promising to communicate further particulars by an early opportunity; and the second, in respect to the case of eggs and cocoons of the Eria or castor-oil silk-worm (*Attacus Ricini*) which were despatched about four months ago. This second has unfortunately proved a failure, as shewn by the following extract of Dr. Bennett's letter:—

"Your favor, dated 11th February, advising us of the despatch of the package of castor-oil silk-worms, arrived in due course, together with the case itself.

"We think you have exercised excellent precaution in adopting the two methods of packing, and that it is very probable we may yet effect the introduction of this most desirable species of silk-worms in the present instance. We have not been so fortunate as to have any success. Upon landing, the box was found to have been roughly used—so roughly that the soil in the Wardian case had been turned over, covering the ova and burying most of the cocoons in one part. The young ricinous plants had manifestly been dead not less than three weeks and the glass broken. In the other compartment everything was firm, except that the lines attaching the cocoons to the cylinder were loose, and the strings adrift. The cocoons must have been good, for all but three had emerged, including all in both compartments, and probably some had been alive until within quite a few days of arrival. * * *

"Upon consultation we can discover no reason why we should not succeed, and this Society trust you will continue us your most valuable assistance this season, for according to Mr. Brady's opinion the period at which this letter should reach you, and for some weeks after, would be most propitious for despatch, and the immediately succeeding time the best for this particular worm to arrive in this hemisphere. We should, therefore, feel greatly obliged if youwill afford us your valuable co-operation, and repeat the experiment as soon as practicable.

"We have official despatches from your Government this moment to hand, to which we will reply by next mail; in the meanwhile we beg you to accept our best thanks for your kind attention."

The Poisonous Properties of Andromeda Ovalifolia.

The Secretary next drew the attention of the Meeting to a paper by Dr. Cleghorn, published in the Society's Journal, Vol. 14, on the poisonous properties of certain species of *Andromeda*, more especially in respect to *A. ovalifolia*, so common in our Himalayan stations; and to another paper from Mr. Landells, in Vol. I, New Series, on the agricultural capabilities of the Hazara country. In this communication, Mr. Landells refers to the mortality amongst goats and sheep in that locality caused by eating of a particular shrub. Mr. Landells submitted the leaves of this plant to the Society, which he (the Secretary) not being able to get identified here, had forwarded by a recent mail to Mr. Grote for submission to Dr. J. L. Stewart (at present in England), who had explored the Flora of Hazara and Khagan, and published an interesting paper thereon in the

Society's Journal. Mr. Grote mentions in a recent letter that Dr. Stewart had compared this specimen with harbarium specimens at Kew, and pronounced them to belong to *Andromeda ovalifolia.* The foliage of the plant, Dr. Stewart states, varies considerably.

Miscellaneous Communications.

The following lettters were also read :—

1.—From J. Hunter Blair, Esq., Honorary Secretary, Government Experimental Farm at Sydapet, Madras, enclosing a report by Mr. Robertson, the Superintendent, on horse-gram (Kooltee) *Dolichos uniflorus,* as a green fodder plant under dry cultivation.

Mr. Blair was requested to favor the Society with a quantity of this Bean for rial in Bengal.

2.—From F. Halsey, Esq., Umritsur, in reference to *Dodonæa Burmanniana* as a hedge plant. The following is extract of Mr. Halsey's letter :—

"In the Proceedings of the Meeting of the Society of 19th May, I observe some remarks made by Mr. Jennings with reference to the *Dodonæa* (not *dioica*) but *Burmanniana.* Although the treatment recommended by Mr. Jennings will answer, yet it is far preferable to sow the seed where it is to remain, as the plant has a longer tap root than any other plant I have ever seen. It is found in its wild state in the Salt Range in the Punjab, and is universally used here to make hedges, and I can assure you there is no better or more beautiful plant in existence for the purpose. This tap-root I have spoken about I am afraid will prevent its introduction to Calcutta and Lower Bengal, unless it were sown upon a bank. It should be surrounded and watered, so that it may be up before the heavy rains fall. It will then grow with great rapidity.

"I have plenty of seed freshly gathered which I can send you; but perhaps a trial had better be made with what you have got from Mr. Jennings, and should it succeed I can collect for you any amount you may want next year. *It must not be sown in a low place.*"

The Secretary mentioned that so great had been the demand for this *Dodonæa* seed, that he had requested Mr. Halsey to send some of his recently gathered stock.

3.—From T. M. Kirkwood, Esq., Canal Revenue Supdt., Bengal, submitting for perusal a memo. on cocoanut cultivation on the Orissa Canal, and requesting the favor of any suggestions that may occur.—Complied with.

4.—From the Secretary, Chief Commissioner, Mysore, asking for information in respect to the best description of foreign grasses for introduction into that province as forage for cattle.

5.—From the same, tendering the thanks of the Chief Commissioner for the information afforded, and requesting to be furnished with such of the seeds of foreign grasses as can be supplied.

6.—From the Commissioner, Nagpore Division, applying for Rheea plants for the garden of the Nagpore Society.

The Secretary stated he had given the same reply to this as to numerous previous applications for Rheea plants, to the effect that since the resumption by the Govt. of Bengal of the Society's garden, they had not been in a position to meet this or other constant applications for useful plants.

7.—From T. D. Forsyth, Esq., Sealkote, applying for seeds for distribution in his approaching visit to Yarkand and Kashgan. "Having been ordered by the Viceroy," writes Mr. Forsyth, "to pay a visit to Yarkand and Kashgan, and to endeavour to open out friendly communication between the people of Eastern Turkestan and Hindostan, I think advantage should be taken of the opportunity to introduce our European seeds of all kinds, into those countries, and in return I propose to bring back samples of the cereals and vegetables, fruit, &c., from here.

"I have seen at Leh in Ladakh some wheat brought from Yarkand, and it was equal to the finest flour imported from Europe. Yarkand is said to be famous for its fruit.

"Will you kindly send me a parcel of seed, as much as you can spare, and I will distribute them in Yarkand and send your Society as large a parcel of Eastern Turkestan products as I can collect."

The Secretary intimated he had at once forwarded to Mr. Forsyth such seeds as were then available, with the promise of sending larger quantities as soon as the Society's new supplies are received.

For the above contributions and communications the best thanks of the Society were accorded.

Wednesday the 20th July 1870.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

Col. S. Becher, Dr. R. A. Barker, Messrs. D. W. Campbell, D. G. Kerklotts, J. A. Gregory, Baboo Punchanund Mittra; Manager of Raj Shewur, Tirhoot; Dr. Howard, Messrs. W. Bull, F. S. M. Riach, H. Robarts, S. Creswell, E. Buck, and President, Municipal Committee, Allyghur.

The names of the following gentlemen were submitted as candidates for election :—

Walter A. Byrne. Esq., Opium Department, Ghazeepore,—proposed by Mr. C. F. Wintle, seconded by the Secretary.

J. A. Brown, Esq., Superintendent of Roads, Cachar,—proposed by Mr. Geo. Grace, seconded by the Secretary.

J. G. Camonins, Esq., Telegraph Master, Cachar,—proposed by Mr. Grace, seconded by the Secretary.

J. C. Robertson, Esq., c.s., Allahabad,—proposed by Mr. S. Jennings, seconded by the Hon'ble C. A. Turner.

G. Adams, Esq., c.s., Kirwee,—proposed by the Secretary, seconded by the President.

Markham Buskin, Esq., Seriporo Factory, Chuprah,—proposed by Mr. E. G. Buskin, seconded by the Secretary.

Secretary, Local Committee, Chanda,—proposed by the Secretary, seconded by Mr. W. Stalkartt.

H. H. the Maharajah of Bettiah,—proposed by Mr. T. M. Gibbon, seconded by the Secretary.

Baboo Harrendhur Kishore Sing, Bahadoor, Bettiah,—proposed by Mr. Gibbon seconded by the Secretary.

A. Christian, Esq., Putterghat Factory, Mudheypooru, Bhaugulpore,—proposed by the Secretary, seconded by the President.

D. C. Halkett, Esq., c.s., Mozuffernugger,—proposed by Mr. R. H. Smith, seconded by the Secretary.

Capt. Holloway, 5th Irrgr. N. I. Nagode,—proposed by the Rev. H. Corbyn, seconded by the Secretary.

A. Strand, Esq., Stock Broker, Calcutta,—proposed by Mr. S. P. Griffiths, seconded by Mr. J. G. Meugens.

W. Trevor Law, Esq., Advocate, Moulmein,—proposed by the President, seconded by the Secretary.

W. A. Howe, Esq., c.s., Bulleah, Ghazeepore,—proposed by Mr. C. F. Wintle, seconded by the Secretary.

J. Pearl, Esq., Tea Planter, Debrooghur,—proposed by Mr. J. M. Wood, seconded by the Secretary.

G. B. T. Dalton, Esq., c.s., Monghyr,—proposed by Mr. G. N. Barlow, seconded by the Secretary.

Secretary, Municipal Committee, Jhung,— proposed by the Secretary, seconded by Mr. W. Stalkartt.

Capt. W. L. Samuells, Assist. Commissioner, Chôta Nagpore,—proposed by Capt. R. G. Smyth, seconded by the Secretary.

Baboo Debendur Mullick, Calcutta,—proposed by Rajah Suttyanund Ghosal, seconded by Baboo P. C. Ghose.

Re-joined.—B. R. Landale, Esq., Bhojpore Factory, Doomraon—and R. D. Stewart, Esq., Raneegunge.

The following contributions were announced :—

1.—Administration Reports for 1868-69 for the Punjab and its Dependencies; for the North Western Provinces; for the Madras and Bombay Presidencies, and for British Burmah,—from the Government of Bengal.

2.—Monthly Reports for the Department of Agriculture at Washington, from January to April 1870,—from the Consul-General, United States of America.

3.—A few seeds of *Begonia* and *Gesnera*, of fine varieties,—from Dr. T. Beaumont.

4.—Seeds of New Zealand Flax, and of the Tuscac grass,—from John Thomson, Esq.

5.—A small assortment of French Pine and other seeds,—from Dr. C. F. Tonnerre.

6.—A bag of the Wheat from the Ghazeepore district referred to in his communication read at the last Meeting,—from J. A. Sturmer, Esq.

7.—Stones of the wild Mango of Cachar,—from C. Brownlow, Esq. Mr. Brownlow is under the impression that these seeds might answer for stocks, as they are very free growers, and, being small and light, they occupy little space. (A portion of these stones has been transferred to the Royal Botanic Gardens.)

8.—Seed of acclimatized Artichoke, and of *Dodonæa Burmanniana*,—from F. Halsey, Esq.

Dr. Earle of Kishnaghur remarks in reference to the doubt expressed at the last Meeting by Mr. Halsey of the suitableness of the climate of Bengal for this fine hedge-plant (*Dodonæa*) that it thrives beautifully at his station, and forms a very pretty hedge. "About three years ago," —Dr. Earle adds,—"one of the residents sowed some seed as an experiment, and it has succeeded admirably."

9.—A small supply of Hill Ginger roots,—from Lieut. J. F. Pogson.

The following is extract of Mr. Pogson's note regarding this ginger :—

"The ginger sent is common bazar ginger, price 8 to 9 pice per seer. The new crop will not be harvested till October-November, and I will then send you picked specimens. The ginger plants should be watered once a week but not deluged. The subsoil should be porous. We get 12 to 14 seers for the rupee of green ginger in October, but it is cheaper elsewhere. The best kind grows in the Subathoo district. Like the grafted mangoe, this kind is not stringy, whilst the common sort is more or less stringy."

The Secretary mentioned he had transferred a portion of these tubers to Mr. Scott, Curator of the Royal Botanic Gardens, who thus writes regarding them :—

"The roots of Ginger from Lieut. Pogson are very fine indeed. It is more pungent, I think, than the kind we get here, also more fibry and darker colored; not unlike the inferior West Indian sorts, which are subjected to a bleaching process of exposure to the fume of chloride of lime or burning sulphur. Any light, rich soil suits ginger; in low, damp grounds the roots quickly rot."

HINTS FOR THE SUCCESSFUL CULTIVATION OF HYACINTHS AND OTHER BULBS IN CALCUTTA.

Read the following brief notes from Mr. Archibald Rogers, who has been successful in blooming some of the ornamental bulbous plants of Europe in his garden at Allypore, near Calcutta :—

"The bulbs ought to reach this country by the middle of October, and should be at once planted in flower-pots filled with a mixture of leaf-mould, sand and

common garden earth. I have on several occasions had bulbs sent out from England by Parcel Post, in a loose bag; each bulb wrapped in a separate piece of waterproof cloth, and they have always arrived in perfect order. As soon as the first green shoots show themselves above ground, the flower-pots should be covered during the day with bell-glasses, or inverted lamp shades, having the socket-ends well corked, and should be kept during the day close to the north wall of the house so as to get no sun. After sunset the glasses should be removed, and the plants exposed to the dew and radiation until seven or eight o'clock on the following morning. If the flower shoot is slow in rising out of the bulb after making its appearance, its growth may be accelerated by standing the pot a few inches deep in water. By the above means I have been very successful with hyacinths, and have got one tulip to flower; and the same treatment applies equally well to Narcissi and Jonquils."

SILK CULTIVATION IN THE PUNJAB.

Submitted the following rejoinder from Mr. Henry Cope to Capt. Hutton's remarks which were read at a recent Meeting of the Society:—

"I have read Capt. Hutton's remarks on my facts regarding silk cultivation in the Punjab, submitted to the Meeting of your Society held on the 23rd April last. I do not consider your Meetings as presenting a suitable arena for arguments and counter-arguments in support of theories, and shall, therefore, not enter into any such in respect to those remarks. Nothing that Capt. Hutton can allege will shake the fact that silk has been successfully cultivated for more than twenty years in the Goordaspoor district; that the silk is of increasing merchantable quality; that the produce has increased very materially of late years; and that the *practical* Sericulturist, Jaffur Allee, and his fellow-laborers in the field, see no reason for believing there is any deterioration in the worm or in the cocoon. That was in effect all I set forth, and that is all I still maintain, with the very reasonable corrollary that, if silk can be and is cultivated successfully at a mean distance of thirty miles from the foot of the hills, that is *in the plains* of the Punjab adjacent to the hills, it can be similarly cultivated on localities still further *within* the line. So different is the climate of Deenanuggur, for example, to that farther south and west, that all produce of its neighbourhood is known as the produce of the "pahars," *Paharee*, in the markets of Umritsur.

"Capt. Hutton should not place any faith in "reports" when dealing with matters of this kind. In the experiment I alluded to as having yielded 17 per cent profit, I received *no* Government aid whatever; such aid was liberally granted on former occasions, but on this I desired to test the cultivation on its merits and succeeded, but, as I said in my previous communication, I considered the success exceptional.

"I cannot *assert*, but it is my well-founded belief, that Jaffur Allee, and his fellow-labourers do not on any occasion import fresh stocks of eggs from outside, they are satisfied with their own produce from year to year and it is not because I, years ago, then and even now practically a mere tyro, suggested that

eggs should be sent from Umritsur to the hills for better preservation, that the proved ability of the Goordaspoor eggs to resist the effects of local climate is to be impugned. That they *do* exist is beyond a doubt. It is a fact, which no argument can upset, and which Capt. Hutton can at once verify by simply asking for information on the subject from any responsible party in Goordaspoor.

"I have great respect for Capt. Hutton's valuable contributions to the field of sericultural knowledge, but I cannot allow that respect to blind me to the undoubted value of the facts I have set forth, and the correctness of which I maintain."

Potato Culture at Furruckabad.

Read the following remarks from Lieut. Pogson in reference to Mr. Buck's communication submitted at the last Meeting:—

"In your last Proceedings we have the second instance of the failure of a valuable crop from the effects of using a wrong manure,—I allude to the Furruckabad-Potatos. The bones as manure will do no good, and the manure already used is rich enough in nitrogen. The land is simply exhausted of its lime, and if 15 maunds of slaked lime or chunam is applied to each acre, the soil will be restored to its proper state. But as the seed potatos are diseased, either new seed must be introduced or else only sound eyes should be planted. These may or may not produce sound potatos, and if Darjeeling or Cherra-Poonjee potatos of the crop of 1869 are procurable, it is far better to incur the expenses of purchasing them for seed in place of trusting to seed known to be diseased. The proper crop to follow the tobacco is either cabbage or cauliflower, and then peas, beans, or wheat. But until the soil is limed it cannot produce sugar-cane, beet or potatos; one hundred maunds of potatos contain 25 of solid matter, *i.e.* starch and gluten. This is derived from the carbon in the soil, and if this be exhausted night-soil cannot supply it, as, though rich in nitrogen, it is poor in lime and carbon. Bone manure is best adapted to grain crops and grasses, and to all lands deficient in phosphates.

"Night soil is rich in phosphates, therefore to apply bones to land so manured is time and money thrown away.

"The method of making bone-manure is laid down in the first part of my Manual, which Mr. Buck can get from Wyman's."

The Secretary mentioned, in reference to the closing part of the above letter, that Lieut. Pogson had informed the Council that he had been obliged to suspend the publication of his Manual on Agriculture for want of support. "Two Governments only have subscribed for the work;"—adds Mr. Pogson—"one has taken six and the other five copies. Under these circumstances I think it best to wait before incurring further expense."

Read a letter from the Under-Secretary, Government of Bengal, forwarding copy of a dispatch and of its enclosure from Her Majesty's Secretary of State,

showing the means adopted by His Grace to promote the introduction of the Ipecacuanha plant into India.

Read also a letter from the Cotton Commissioner, Central Provinces and the Berars, forwarding copy of his letter to the Chamber of Commerce at Bombay on the Cotton season of 1869-70.

The Rajah Suttyanund Ghosal exhibited a fine plant in flower of *Eurycles Amboinensis* and one of perennial Phox, also in full flower.

For the above communications and presentations, the best thanks of the Society were accorded.

Wednesday, the 17th August 1870.

J. A. CRAWFORD, ESQ., *President, in the Chair.*

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

Messrs. W. A. Byrne, J. A. Brown, J. G. Camonins, J. C. Robertson, C.S., G. Adams, C.S., M. Buskin ; Secretary, Local Committee, Chanda ; H. H. the Maharajah of Bettiah ; Baboo Harrendhur Kishore Sing, Bahadoor ; Messrs. A. Christian, D. C. Halkett, C.S., A. Strand, W. T. Law, W. A. Howe, C.S., J. Pearl, G. A. T. Dalton, C.S., Captain Holloway ; Secretary, Municipal Committee, Jhung ; Captain W. L. Samuells, and Baboo Debundur Mullick.

The names of the following gentlemen were submitted as candidates for election :—

Captain H. R. Wintle, 18th N.I., Gorruckpore,—proposed by Colonel E. H. C. Wintle, seconded by the Secretary.

Dr. Hoskins, Civil Surgeon, Ranchee,—proposed by Mr. R. W. King, seconded by the President.

J. H. Haworth, Esq., Broker, Calcutta,—proposed by Mr. J. M. Ross, seconded by the Secretary.

F. A. Gillam, Esq., Agent, Bank of Bengal, Mirzapore,—proposed by Mr. F. Halsey, seconded by the President.

F. J. Marsden, Esq., Barrister,—proposed by Mr. H. A. Gray, seconded by Mr. J. G. Meugens.

Manager of the Estate of the Maharanee of Dinagepore,—proposed by Dr. J. V. B. Webber, seconded by Mr. E. V. Westmacott.

W. F. Meres, Esq., C.S., Hooghly,—proposed by Dr. R. F. Thompson, seconded by the Secretary.

B. E. C. Comber, Esq., Tea Planter, Debrooghur,—proposed by Mr. J. M. Wood, seconded by the Secretary.

Frederick Jones, Esq., C.S., Serampore,—proposed by Mr. F. H. Pellew, seconded by Dr. R. F. Thompson.

Mrs. Annie Sandys, Bhaugulpore,—proposed by Mr. P. Onraet, seconded by Mr. J. Dacosta.

George Toomly, Esq., Indigo Planter, Contai, Tirhoot,—proposed by Mr. Walter R. Browne, seconded by the Secretary.

J. C. M. Forbes Esq., C.E., Assistant Engineer, Raj Durbungah,—proposed by Mr. W. H. Stevens, seconded by the Secretary.

Wm. Waterfield, Esq., C.S., Allahabad,—proposed by Mr. S. Jennings, seconded by the Honorable C. A. Turner.

C. C. Wood, Esq., Assistant Commissioner, Rajmahal,—proposed by Mr. E. V. Westmacott, seconded by the Secretary.

Baboo Khetermohun Sing, Dinagepore,—proposed by Mr. Westmacott, seconded by the Secretary.

Rejoined—James Davidson, Esq., of Cachar.

The following contributions were announced:—

1.—Report of the Horticultural Gardens and Museum, Oude,—from the Government of Bengal.

2.—Records of the Geological Survey, vol. III, Part 3,—from Dr. Oldham.

3.—A small quantity of acclimated Cauliflower seed,—from A. J. Sturmer, Esq.

4.—A quantity of seed of the "yellow cholum" *(Sorghum vulgare)*, "Cooltee *(Dolichos uniflorus)*, and maize from seed from Queensland,—from the Honorary Secretary, Government Experimental Farm at Madras.

5.—Seed of "Cooltee" of two kinds, light and dark, from Chôta Nagpore,—from Col. E. T. Dalton.

6.—A good quantity of Cauliflower seed from Lucknow,—from Col. W. S. Row. Colonel Row mentions that this seed has been gathered in his garden from seed bought by his *Malee* from Kumaon. "These heads of cauliflower were the finest I have seen, measuring from 28 to 36 inches in circumference, and yet fit for the table, tender and delicate in flavour. This seed may be useful to Members of the Society in Lower Bengal, where I always found English cauliflower seeds produce very poor heads."

7.—A collection (7 kinds) of acclimatized flower seed,—from W. Stalkartt, Esq.

8.—Samples of wheat raised in Tirhoot from Australian stock of the "Purple Straw," "White Lamas," "Red Tuscan," and "prolific" varieties; sample of country wheat for comparison, and a fine sheaf of oats from country stock; also Australian and indigenous flax seed,—from C. E. Blechynden, Esq.

Mr. Blechynden reports that the barley and oats received at the same time from the Society, did not come to grain; they were too late, as indeed were all the sowings. The oats from country seed produced 30¼ maunds from 18 beegahs.

These wheats from Australian stock have retained their original character very well. The sheaf of country oats is well filled in grain, and the straw is excellent.

9.—A larger sample of the Nankin cotton cloth, (which was submitted at the June Meeting), prepared in the Nagpore Jail,—from Dr. John Brake, Inspector General of Jails, C.P.

Dr. Brake states, in reply to an enquiry, that this fine strong cloth is sold at one rupee per yard of a width of 34 inches.

10.—A large sample of tobacco raised in the Dilkhoosh Garden of the Maharajah of Burdwan, from the James River Virginia seed,—forwarded by the Collector of Burdwan.

HYBRIDIZATION OF COTTON.

Read a letter from the Cotton Commissioner, Central Provinces and the Berars, forwarding for the information of the Society, the following extract of a letter from Major Trevor Clarke, to his address, dated Daventry, the 7th May 1870:—

"I have just had a letter from Ashburner with some beautiful Hingunghât bolls, and some from a selected plant with naturally yellow tingled staple. I do not know if you are acquainted with *Coconada*, which is a cotton of this sort; now the said Coconada is much sought for by spinners, strange to say, on account of the *colour*. I have grown Coconada, and pronounced it at once to be allied to the Hingunghât. It would be well, I think, to look out for and propagate a *slightly* Nankeeny-Hingunghât race. Such a breed might be produced by crossing with a good yellow *Indian*, not American, sort. A Nankeen cotton is cultivated in India, which is of occidental race, not G. Herbaceum at all. This would not cross with the real Oriental breeds.

"Your samples of seed came too late in the English year to do much with that season, but I managed to get a crop or two, the seed by great care being got to ripen during the late autumn and winter. Amongst others, I believe, I have crossed the purple-flowered G. Arboreum, your "Nurmah," with Hingunghât. I wish you would make your people test the capabilities of this plant. There are several accounts of its having been tried, and all apparently with favorable result; but nothing further appears to have come of it. The staple is undoubtedly good, strong, white, and fine, and was much admired by a spinner, a friend of mine, a first-rate judge. The crop will come quicker to maturity and should be longer, softer, and more to the boll. The only Indian cottons that at all come up to the *bulky* properties of Uplands, according to my experience, are produced by that breed of which the bolls are dumpy and cob-nut-shaped, and only *half* opening when ripe. Dhollera and Western Madras, as supplied to me, are of this kind. Now a cross between a high class plant of this form and a good Hingunghât would be a great step, because the big, close-pod sort produces a hard staple, at least as far as I have seen. Let your people turn their attention to the task of observing and tabulating, as it were, the *peculiarities* of *breeds*, especially as to adaptation to different soils and climates. As far as selection goes, soft staple should be looked for amongst harsh fibred, but otherwise good sorts, and hardy varieties in the case of first-class stapled kinds which are constitutionally tender.

"My cross Hingunghât by Nurmah (Arboreum) is good,—that is, has taken effect. Also Hingunghât crossed by the largish stapled close-pod sorts. Also the Assam Hill Cotton by Hingunghât.

"I have just had a sample of this very interesting kind from the Agricultural and Horticultural Society of India, through Mr. Arthur Grote. I enclose some of its long, many-seeded tufts grown by myself. I wish the staple was as long in proportion. I shall enclose with this a few more seeds of the "former" sorts, in case any of the first lot may have been unsuccessful, also a few other such sorts as I think may be useful or interesting. The crosses, Sea Island by New Orleanss by New Orleans and the Hybrid Georgian, are most beautiful cottons, Orlean, staple, as soft as silk. I do hope they may succeed with you. I am also very curious to know the behaviour of the sort I call Pernambuco and its crosses. It is shortish in staple, but the very hardiest sort I have ever met with. In crossing it I went in for a *hardy* Sea Island, and cannot help thinking I have effected my purpose.

"My most interesting cross, *viz.*, Hingunghât by Arboreum (*i.e.*, Nurmah) is thriving, and will soon flower, showing that it has secured the early flowering habit of the Hingunghât parent; of it I send you one or two seeds. I had only one small boll come to perfection.

"Among the seeds now sent are a number between Hingunghât and the broad-leaved type in the close pods and strong bulky staple. I hope this will produce sorts with more expanded pods and finer staple combined with *length*. The Hybrid Georgian, as I call it, and the Sea Island, twice crossed with New Orleans, are most beautiful cottons. Try your best to get these into fruit. I send also several kinds of Uplands and Sea Island."

Experimental trials with Japanese Silk Worms in Bengal.

Read a letter from Mr. G. DeCristoferis, dated Gadee, *viâ* Jungypore, in continuation of his communication submitted at the April Meeting. *(See Correspondence and Selections.)*

Hints for the further improvement of Bengal Raw Silk.

The Secretary read a note from Mr. S. P. Griffiths, forwarding copy of a Circular which he had received from Messrs. Frederick Huth and Company of London, on the defects of Bengal raw silk, and giving suggestions which, if attended to, would greatly improve the quality of it.

This Circular is signed by Messrs. J. B. Martin, plush and velvet manufacturers, of Tavare, Paris, Lyons, Metz and Roanne, and is dated from Lyons, 1st July 1870.

Agreed that this Circular be incorporated in the Proceedings of this day's Meeting, with the view of drawing greater attention to the subject on which it treats:—

"For several years past the standard of quality of Bengal raw silk has singularly lowered, and on this account those who habitually used this class of silk in large quantities, have abstained and still abstain from purchasing them.

"As we are ourselves regular customers for this silk, and consequently well able to make a correct estimate of their worth, *throwing them, as we do, in our own mill, dyeing them on our own premises, and lastly weaving them on our own looms,* we venture to offer such practical observations, which, if taken into serious consideration, may tend to ameliorate the quality, and consequently render the silk more saleable on this and on other markets and at MUCH higher prices than can now be obtained.

"We can attribute the inferiority of Bengal silk to the following causes (we speak of first-class filature silk, as we cannot use other qualities) :—

"1stly.—*The Size, which is spun too fine.*—Bengal silk, being of a soft and brittle texture requires to be spun from at least 7 to 8 cocoons, which would make 14 or 17 deniers. This size, we think, would be to the best advantage of quality, and is in fact the size usually received SIX OR SEVEN years ago, when Surdahs were so superior.

"2ndly.—*In one and the same parcel of silk, we often find different qualities mixed up together, which is very prejudicial.*—Each filature ought to be sold separately, and the second-rate quality, after careful selection, put aside and also sold separately. As it is now, we often find in the same bale some pale coloured skeins and others of a bright colour, some long and some short, in fact evidently wound upon different swifts and consequently of divers filatures. This compels us to go through the process of choosing the different qualities, skein by skein, which, besides being tedious, deteriorates the quality of the silk.

"The pale coloured skeins are always the best.

"3rdly.—*The hanks are in general too heavy*—which is a great impediment to the winding, the swifts having to bear the greater weight, turn too heavily and snap the thread much more frequently than if the skeins were lighter.

"*Summary.*—We would advise spinners of Bengal silk :—

"1stly.—To spin a thread of 7 to 8 cocoons, which will make 14 or 17 deniers, a size preferable in every respect.

"2ndly.—Not to mix up in the same parcel the silk of one filature with that of another, and silk of inferior quality to be made up in separate bales.

"3rdly.—To make the skeins lighter and of even length."

Exotic Tobacco cultivated in the Burdwan District.

Submitted the following communications in respect to the tobacco, of which samples were placed on the table :—

From the Offiiating Collector of Burdwan, dated 2nd August 1870.—"In forwarding herewith copy of a letter from the Maharajah of Burdwan to the address of my predecessor, No. 60, of the 23rd May last, together with a quantity of tobacco weighing about 6¾ seers, raised by him from the James River Virginia seed supplied by Government, I have the honor to request that you will be good enough to favor me with the opinion of the Society as to the result of this experimental cultivation of the American seed."

From H. H. the Maharajah of Burdwan to the Officiating Collector of Burdwan. —"With reference to your letter No. 253, dated 6th September 1869, I have the honor to state that the James River Virginia tobacco seeds you kindly placed at my disposal having been very small in quantity, I thought it convenient to see how they would vegetate in my Dilkoosh garden.

"I learn from the report submitted to me by the Superintendent of the garden, that the seeds were first sown in pots filled with leaf-mould and the top covered over with sand, and that they germinated, according to his estimate, from 75 to 80 per cent.

"These seedlings were transferred to a bed prepared to receive them, and allowed to remain there until they had given out from five to six leaves each. Thence they were transplanted in October last, and cultivated in the mode in which tobacco is grown in this country in a plot of ordinary garden soil, with copiously mixed up vegetable and horse dung manure in equal quantities. Due care was of course taken of them as they went on growing, and the leaves cured in the usual way. The ground cultivated was 12 by 24 feet.

"The whole quantity of tobacco, weighing 6 seers and 14 chittacks, is herewith sent.

"I shall feel much obliged by your sending these to the Agricultural and Horticultural Society at Calcutta, and obtaining their opinion as to how far this experiment has been a successful one.

"In the event of the experiment proving hopeful, I have a mind to have some more of this American tobacco seed for trying, on an extensive scale, how they will grow in my zemindaries in Midnapore and Cuttack."

Dr. Tonnerre kindly agreed to examine and report on this tobacco.

In connection with the above, the Secretary submitted a communication from the Secretary to the Government of the North-Western Provinces, forwarding, by desire of the Lieut.-Governor, reports from the Superintendent of the Botanic Gardens, North-Western Provinces, and from the Collectors of Saharunpore, Meerut, Agra, Cawnpore, and Furruckabad, on the experimental cultivation of American James River Virginia tobacco during the year 1869 :—"These experiments, though conducted by officers who were sure to give them a fair trial, have not, on the whole, proved successful."

Agreed—That these reports be published in the Journal for record.

Irrigation by Wind Power.

Read the following letter from Mr. H. A. Harris of the Bengal Marine, dated 12th August:—

"On the 20th of July, I addressed the Bengal Government on the subject of Irrigation by Wind Power, and on the 6th of August a few remarks of mine on the same subject appeared in the *Indian Daily News* which you have no

doubt seen. I now beg to offer to any Member of the Society who feels an interest in this method of irrigation, a small Windmill Pump complete, well suited for a gentleman's garden, and in good working order, on the following conditions:—

"1st.—The pump will be put up by me free of all charge.

"2nd.—A good situation open to all winds must be found.

"3rd.—That if it works satisfactorily, the recipient will aid me in introducing them to the Province of Orissa and other parts of India, for which I am convinced they are well adapted.

Dimensions of Pump and of Model.

Stroke, about 6 inches.

Diameter of pump, $3\frac{1}{8}$ inches.

Diameter of sails nearly 8 feet, *i.e.*, each sail 4 feet.

Lift, about 12 feet.

No. of sails, 4.

"Should my offer be thought worthy of notice, a reply will oblige. The present model is best adapted for a well, but could be placed over a tank if necessary."

Agreed—To introduce the above letter in this day's Proceedings, with the view of inviting a response to the offer of Mr. Harris from any one interested in the subject.

HORTICULTURAL NOTES.

Read the following extract of a letter from Dr. T. Beaumont, Residency Surgeon, Indore, on the successful transmission of a collection of cuttings, by pattern post, of ornamental shrubs, climbers, and perennial plants:—

"I should have written sooner to thank you for the very extensive collection of cuttings you were so kind as to send me, but I waited that I might be able to tell you how they were likely to do. They arrived in very good good condition, having been packed most carefully; and on opening the package, I found several had already begun to form callus. Indeed, I hope that all of the varieties that take with moderate readiness from cuttings will do."

The Secretary stated that, encouraged by this success, and by favorable reports subsequently received from other Members, also residing a considerable distance from the Presidency, he had obtained, through the kindness of the Curator of the Royal Botanic Garden, a selected list of such plants generally available at the nursery department of the Society as could be propagated by cuttings. He had had many copies of such lists printed, in consequence of numerous and annually increasing applications from non-resident Members for ornamental plants, and the heavy expense and risk attending the conveyance, for any distance, of rooted plants by line of rail, bullock train and other conveyance. By this less, almost inexpensive, mode of transit by pattern post, Members in all parts of India may readily avail themselves of such cuttings, and thus, at a

trifling cost to themselves, carry out one of the primary objects of the Society, *viz.*, the extending of such culture throughout the country.

The Secretary next read a letter from Colonel W. S. Row, in respect to the goodness of the seeds imported last year by the Society, of which the following is an extract:—

"I hope this year's seeds will turn out as good as those of last year, which certainly were the best I have ever received during the 16 years I have been a Member of the Society. Not a single packet of any description having failed with me, not even of the peas, which I always found the most disappointing. I am sorry I did not make trial sowing last year, and send you tabular statements of the results. I will, however, endeavour to do so this year, and communicate with you again hereafter on the subject."

In connection with the above, the Secretary placed on the table sample packets of American vegetable seed just landed from the Steamer *Bolivar*, *viâ* the Suez Canal. This steamer had to run up to Bombay from Aden (in consequence of an accident to her machinery), instead of proceeding direct to Calcutta; and this had, unfortunately, delayed the distribution of these seeds for six weeks. The arrival of the French and Australian vegetable and flower seeds had only just been announced; the former by the *Imperatrice Eugenie*, and the latter by the P. & O. Co's steamer *Rangoon*. These are both a month later than anticipated. He brought these facts to notice, in consequence of the receipt of several letters from Members complaining of the delay this year in obtaining their shares. They would now be distributed with all possible despatch.

The Secretary next drew attention to a few plants of *Araucaria* on the table. These formed portion of the contents of a Wardian case recently transmitted by Messrs. Law, Somner & Co., of Melbourne, by the P. & O. Co.'s steamer to his care, for the Public Garden at Allahabad. It was about the most successful shipment in his (the Secretary's) experience. The case contained 40 plants of *Araucaria Bidwilli* and 28 plants of *A. excela.* With the exception of three or four plants of the former, which looked sickly, but which may be recovered by careful nursing, the plants had reached in excellent condition.

The Secretary further brought to notice some fine cut specimens of double Zinnias and Balsams raised in his garden from seed presented by Mr. R. W. King of Ranchee. He also placed on the table, for distribution, a packet of seeds of three kinds of *Ipomæa* with *variegated foliage*, which had likewise been gathered from seed received from Mr. King.

China Grass.

Read a letter from Mr. James Montgomery, of the Ram Bagh, Kangra, in reference to the culture and preparation of China grass (*Bœhmeria nivea*). Mr. Montgomery intimates that having observed from recent reports of the Proceedings of the inability of the Society to meet requisitions for this plant, he will

be glad to supply any number of roots at certain rates. The plants are of the genuine Chinese variety, reared by him from imported seed. The stems average 7 feet in height, many reaching 9 to 10 feet. Mr. Montgomery encloses a specimen of fibre from freshly cut stems, which possesses good length, great strength, and a much whiter color than the fibre obtained from the Rheea of Assam.

In a subsequent communication, Mr. Montgomery writes at greater length, of which the following are extracts :—

"In reply to your queries, I have the pleasure to inform you that my plantation has been stocked from the produce of seed obtained, with great difficulty, from China in March 1864.

"The plants produce seed freely here, which would doubtless germinate readily, as shown by the number of self-sown plants that spring up every year in the vicinity of my cultivation; but I have increased my stock by planting divisions of the roots, which is a certain and quicker method of obtaining strong plants. Moreover, to save seed the spring shoots must be left untouched until the seed has ripened in autumn, thus losing at least three cuttings. The plant cut down this month will throw up a strong crop of new stems in a few weeks, which, is allowed, will flower freely, but not perfect the seed. I have not seen the Assam variety (*Rheea*) growing, but have received many specimens of fibre stated to have been obtained from it. All were more or less tan-colored; none so white as that I have separated from my plants. The specimen I sent you had been hurriedly prepared by hand. I have not yet been able to employ machinery.

"I entered on this enterprise in 1863, and had scarcely obtained a site for operations than the extensive commercial failures in England ruined my supporters, before even the machinery and appliances ordered had been despatched. I was thus thrown entirely on my resources, and have with the greatest difficulty maintained the plantation up to the present time, throwing away the produce from want of means to utilize it. It is possible that Government may purchase it; if not then I shall probably have to abandon it, and sell or rent the land for the common cultivation of the district.

"Any information regarding China grass that my experience enables me to give, I shall be happy to afford you."

The Secretary mentioned he had requested Mr. Montgomery to favor him with a small quantity of the seed of his plant.

Letters were also read—

From Captain Thomas Hutton, a paper for the Journal on the culture of Silk in the Australian Colonies.

From Major F. J. Millar, Deputy Commissioner, Goordaspore, in respect to the effects of the local climate on the eggs of the mulberry silk moth, in reference to the remarks in Mr. Cope's communication on silk cultivation in the Punjab, which were published in the last month's Proceedings. Major Millar observes that from enquiries made he finds that the stock of the silk cultivators is not

deteriorating to any great extent. "From 15th July to 15th September, during the rains," adds Major Millar, "they lose about one-fourth of the eggs, and have to guard them in earthern vessels (unbaked) with cow-dung ashes. It is also necessary to keep up a very equal temperature at this season, otherwise great loss results. In some years, I am informed, the whole stock of eggs has been lost for want of due care and protection."

For the above communications and presentations, the best thanks of the Society were accorded.

Thursday, the 22nd September 1870.

Dr. C. Fabre Tonnerre, V. P., *in the Chair.*

Read a note of apology from the President for not being able to be present consequent on indisposition.

The Proceedings of the last Meeting were read and confirmed.

The following were elected Members :—

Mrs. Annie Sandys; Capt. H. R. Wintle; Dr. Hoskins; Manager of the estate of the Maharanee of Dinagepore; Messrs. J. H. Haworth, F. A. Gillam, F. J. Marsden, W. F. Meres, C.S., B. E. C. Comber, F. Jones, C.S., George Toomly, J. C. M. Forbes, C.E., William Waterfield, C.S., C. C. Wood, and Baboo Khetermohun Sing.

The names of the following gentlemen were submitted as candidates for election :—

W. J. Herschell, Esq., C.S., Kishnaghur,—proposed by Major H. T. Forbes, seconded by the Secretary.

Thomas Chennell, Esq., Chandaghat Tea estate, Cachar,—proposed by Mr. R. White, seconded by Dr. Tonnerre.

Capt. R. J. Walker, Bengal Staff Corps, 17th N.I.,—proposed by Mr. B. D. Colvin, seconded by Mr. Crawford.

E. M. Slater, Esq., Bank of Bengal, Calcutta,—proposed by Mr. J. Gordon, seconded by Mr. W. H. Cheetham.

F. Eisenlohr, Esq., merchant, Calcutta,—proposed by Mr. S. P. Griffiths, seconded by Mr. J. G. Meugens.

Beerchunder Manick, Bahadoor, Maharajah of Tipperah,—proposed by Mr. W. F. Campbell, seconded by the Secretary.

Ralph Griffith, Esq., M.A., Principal, Queen's College, Benares,—proposed by Mr. M. Brodhurst, seconded by Dr. R. H. Perkins.

A. B. Sutherland, Esq., Calcutta,—proposed by Mr. J. C. Sutherland, seconded by M. R. Blechynden.

A. C. McFarlane, Esq., Calcutta,—proposed by Mr. Sutherland, seconded by Mr. Blechynden.

E. Lamb, Esq., Pursah Factory, Chumparun,—proposed by Mr. T. M. Gibbon, seconded by the Secretary.

Rajah Bejoy Kesub Roy, Bahadoor, of Andool,—proposed by the Secretary, seconded by Dr. Tonnerre.

Lieut. G. Alexander, Assistant Commissioner, Thyet Myo,—proposed by Capt. E. J. L. Twynam, seconded by the Secretary.

R. T. Hobart, Esq., C.S., Etah,—proposed by the Secretary, seconded by Dr. Tonnerre.

Rejoined,—T. E. Carter, Esq., of Calcutta.

Dr. George King was proposed a Corresponding Member on the recommendation of the Council.

CONTRIBUTIONS.

The following contributions were announced:—

1.—Les Fleurs de pleine terre (3rd edition); Instructions pour les servis de Fleurs de pleine terre (2 copies) and Album Vilmorin for 1870,—from Messrs. Vilmorin, Andrieux & Co.

2.—Monthly reports of the department of Agriculture at Washington for May, June, and July 1870,—from the Consul General, U.S.A.

3.—The First Annual Report of the American Museum of Natural History,—from the Trustees.

4.—Address to the Botanical Society, Edinburgh. Session 1869-70,—from Dr. Hugh Cleghorn, President.

5.—Journal of the Asiatic Society of Bengal, Part I, No 2, and Part II, No. 3. —from the Society.

6.—Seed of Mahogany and *Juniperus Bermudiana*,—from Dr. Hooker, C.B.

7.—A small quantity of Guinea Grass Seed,—from Lieut. James Forbes.

(The above seeds are available to Members.)

8.—A quantity of acclimatized Cauliflower seed,—from Mr. James Weston.

9.—A small packet of Lettuce seed,—from Major James Williamson. This seed has been gathered by Major Williamson from plants of a very fine kind raised in his garden at Boston Spa in Yorkshire.

10.—A small collection of Orchids from Assam,—from Mr. J. M. Wood.

11.—A larger quantity of the Gum of the "Koortah" tree of Cachar,—from Mr. C. Brownlow.

Mr. Brownlow remarks that as the quantity now sent (10 lbs.) is larger than which was forwarded in June last, he hopes it will be sufficient for an estimate to be formed of its value. He had some difficulty in collecting it (which would not, however, be the case if there was a demand), and he may not be able to get another specimen so large. Mr. B. adds that they have other gums in Cachar as good, if not better, but none so generally distributed and plentiful.

Resolved—That this sample be also transmitted to Dr. Forbes Watson for report.

12.—A sample of tobacco raised at Gowhatti,—from Mr. D. Bruce.

13.—A sample of cotton raised at Jaunpore,—from Mr. J. G. Fraser.

(Further particulars regarding this cotton and tobacco will be found in the body of the Proceedings.)

Silk Capabilities of the Punjab.

Submitted the following communication from Captain Thomas Hutton in reply to the remarks of Mr. Cope which were laid before the July Meeting:—

"Whatever may be the value of Mr. Cope's '*hard facts*,' as he terms them, I cannot say that I admire either his logic, or his persistence in advertising the Punjab as a proper field for silk culture, especially as he himself lately condemned it by assuring the public that he cannot recommend the re-opening of experiments in which, according to Sir R. Temple's report, he so signally failed. As to his laudation of Goordaspore, it may, for all I know to the contrary, be capable of growing very good silk, but still such a fact could never convert the Punjab into a good silk-growing province. It appears that Mr. Copes' paradise is situated about 30 miles from the base of the Punjab hills, and we are told that everywhere along that base, and within that distance, would probably be found equally good. Well, what then? It does not follow because at the foot of the hills, in a greatly modified temperature, silk can be grown, that therefore it can be successfully cultivated throughout the plains of the Punjab where the conditions of climate are very different; and even although this one belauded spot produces good silk, still it is to be borne in mind that '*one swallow does not make summer.*'

"Against Goordaspore I have nothing to say, for I have never been there, yet nevertheless, I denounce the Punjab in general, and Mr. Cope unwillingly does the same by telling us he cannot recommend any one to re-open experiments in which *he* failed; for he acknowledges that his having made a profit of seventeen per cent. is altogether '*exceptional*.'

"What little I have said of Goordaspore was called forth by the statements of Mr. Cope and Lieut. Powlett, and if my inferences, founded upon those statements were wrong, I have only to thank these gentlemen for giving me false data. For the account formerly given by Lieut. Powlett is now contradicted by Mr. Cope; both statements cannot possibly be true, and as Lieut. Powlett's appears to me, under all the circumstances of the case, to be the most reliable, I am inclined to pin my faith upon him. Mr. Cope now modestly assures us that he is still '*practically a tyro*'; what then was he eleven years ago! And yet he then, in a lecture delivered at Lahore, took the opportunity of sneering at my attempts to extricate our Indian species of *Bombycidæ* from the confusion into which ignorance of natural history had plunged them, assuring his audience that there was but *one species!* How do the facts stand now? It

will, however, be sufficient to substantiate all I have written, if I quote the conclusion to which Sir D. F. Mcleod, then the Financial Commissioner, and Sir R. Temple, then Secretary to the Chief Commissioner for the Punjab, were compelled to arrive at, since it may well be allowed to close this controversy as to the silk capabilities of the Punjab. From Lahore, the 16th July 1856, Mr. Temple thus writes—'In reference to your letter No. 871 of the 27th February 1855, sanctioning a total expenditure of Rs. 17,000 for silk experiments at Lahore, under supervision of the Agricultural and Horticultural Society of the Punjab, to extend up to close of 1856; I am now directed to submit a final report on the subject as follows:—At the commencement of 1855, it was reported that Rs. 5,279 had been already expended, and a further expenditure of Rs. 11,721 was sanctioned for 1855 and 1856, at that time the Agricultural Society *were sanguine* that the outlay *would be at least nearly covered by proceeds.*

"'During the season of 1855, the experiment was vigorously carried on; there was as Superintendent, *a gentleman of much practical skill,** and a staff of eleven silk winders from Bengal. The worms were also, for the most part, of the Bengal species. At first, the generation of the worms was very successful. The insects came forth in surprising abundance; they throve on the mulberry leaves that were given them; and at the first began to spin excellent cocoons,—everything prospered, *until the weather became hot and the atmosphere dry.*' [Precisely my own remarks scattered through several papers.] 'But as the spring advanced towards summer *the food became deteriorated by the shrivelling up of the leaves; the worms grew sickly; and the cocoons fell off.* The early promise was fair, *but the ultimate result was almost* nil. Some 94lbs. of silk were procured, valued at Rs. 500,† where some 800 lbs. had been expected at Rs. 6,000, and there only remained these scanty proceeds to set down against an expenditure of Rs. 12,000. After this season the European Superintendent abandoned the undertaking; but the silk winders remained. Perceiving this state of things, the Chief Commissioner, at the commencement of 1856, directed the Council of the Society to deliberate on the further continuance of the experiment,—copies of the minutes recorded by those officers are appended, as shewing the opinions entertained. It was then decided to continue the experiment ‡ during the season of 1856, by means of *Cashmere silk worms,* as there appeared a hope that perhaps this species would prove more hardy than the Bengal species which had failed during 1855.

"'But from the two reports of the Society herewith appended, it will be seen that the same fate befell the Cashmere worms as the Bengal worms. The Cashmere

* Surely here is no allusion to Mr. Cope, who now 15 years afterwards has wisely come to the conclusion that he is only "a practical tyro."

† About Rs. 10 per seer instead of Rs. 14 per seer.

‡ "Quem Deus vult perdere prius dementat."

orms also flourished at first, but as soon as *the season became inclement, they began to wither.* Their cocoons ultimately produced no more silk than the meagre quantity which was produced the year previous; and the Society pronounce the Lahore silk experiment *to have failed* in toto. The establishments have now been discharged, and the concern wound up.

"'From the abstract account annexed, it will be seen that Rs. 10,569-9-4 have been expended in all; or Rs. 6,430-6-4 less than the sum sanctioned. But the value of the silk produced *is only Rs.* 1,100 *instead of Rs.* 10,000 as originally hoped for by the Society. The result has not been fortunate, but the Government liberally supported the experiment for three consecutive years, and the Society did its utmost in the way of supervision. As regards skilled agency all reasonable advantage was enjoyed; excellent shelter for the worms was provided, and two species of worms were tried.

"'The conclusion, therefore, I am to state, appears to be that the climate in this part of the Punjab *is inimical* to the production of raw silk. *For this purpose an equable temperature and a tolerably moist atmosphere* are required, but in the spring, which is the season for silk spinning, the weather is at first comparatively mild. So long as that lasts the worms thrive, on rich green fodder, and spin fair cocoons, but in *about the middle of April, the weather rapidly changes for the worse and the worms are ruined.* For the northern parts of the Punjab, which are submontane, that is, within the influence of the Himalaya, *different climatic conditions exist.* There the atmosphere may retain its humidity and coolness longer than in the southern districts, and there the production of silk in quantities may be *possible.* Private experiments have been conducted occasionally in some of these places with a certain measure of success,* but there are neither the means nor the agency for such experiments, on the part of Government, available in these quarters. But in the Central Districts of the Punjab, a few pounds of marketable raw silk might be produced as samples, but no considerable quantities can be raised.

'(Signed) R. TEMPLE.'

"Here then we find ample proof of the truth of my statements, that the climate of the Punjab, as a whole, is inimical to the constitution of the Chinese domesticated *Bombyces;* and further, we have evidence, *first*—that the Punjab experiments were a total failure; *secondly*—that in my reports on silk cultivation I have stated nothing but the truth; *thirdly*—that such being the case, no amount of sophistry will serve to make the Punjab a proper field for the cultivation of silk, and *lastly*—that with these strong proofs of utter failure before us, it is high time that this fruitless controversy should be laid at rest. Mr. Cope's continual ill-judged praises of the Punjab being calculated only to mislead those who have learned to regard him as an authority, instead of being only '*practically a tyro.*'"

* "A measure of success," is, in my opinion, a failure!

EGGS FROM THE JAPAN SILK WORM.

In connection with the above, the Secretary read a letter from Mr. G. De Cristoferis, forwarding copy of a letter which he had addressed to Capt. Hutton, in respect to the Japanese eggs alluded to at the last Meeting, of which the following is an extract:—

"I duly received your letters of the 31st August, and 5th and 6th September. When I read in the report of the Agricultural and Horticultural Society that you feared that the eggs I had sent to Mr. Blechynden would not hatch, I thought you might have been too quick in condemning them.

"The eggs were certainly sunken on the upper surface when I sent them to Mr. Blechynden, but by breaking some of them, I ascertained that life was not destroyed yet.

"It is nevertheless no wonder that these eggs should have come out so irregularly with you, and so few at a time! It was not their season to come out at all; but, independently of this, have you ever seen Italian, Chinese, or Japanese annual eggs come out regularly in this country, even when brought out with the greatest care? I think not; and the reason is that no annual eggs will hatch regularly unless they are submitted to the changes of the four seasons in a temperate climate, from the heat of a summer, to the cold of a winter below zero. The Japanese annual eggs that always fail here in Bengal, hatch most regularly in Europe when wanted in the spring. They would not do so in the previous autumn if forced.

"The annual Boro Pullo of Bengal is the only annual eggs that will hatch after a few months of being laid, if proper care is not taken to keep it in a cool place, well protected from the air in an earthen pot. In this way the eggs will keep for the twelve months, and would hatch after a few days of being exposed to the air.

"In future, if you get any annual eggs from China or Japan, I would recommend you to send them up to Darjeeling at once, and to get them back from there in the spring when, with ordinary care, you would find the eggs to hatch very satisfactorily. You may try this with the eggs I sent you, if any are left."

The Secretary also read the few following remarks from Capt. Hutton regarding the above eggs:—

"The eggs you sent me from Mr. DeCristoferis's Japan worm, about 4,000 in number, have produced 25 worms, but these came out sometimes one, at others three, then none, and at the most five per diem; they are, some of them, in the third stage, and have all the appearance of *B. Sinensis*, answering nearly also to the description formerly given by me in the Journal when I sent you the cocoons about which you said nothing. If I succeed in getting any seed from these, I may perhaps restore the worms to order, but I scarcely think Bengal a good climate for Japan species."

Culture of Hingunghat Cotton at Jaunpore.

Read the following letter from Mr. J. G. Fraser, of Gopalapore factory, Jaunpore, regarding the cotton already referred to :—

"I have forwarded to your address a parcel containing one pound of cleaned cotton. It was raised by myself from Hingunghât seed, supplied by the Collector. I departed from the suggestion made by the Cotton Commissioner, and cultivated under a system of transplanting. I sowed broadcast before the rains, and when the plant was about eight inches high, I transplanted at a distance of 4 feet, the rows also being that distance apart. I need scarcely add that after the rains, the field was frequently hoed and watered. The result has been good, and better I fancy that any grown under the ordinary system. The produce has been 280lbs. per Jaunpore bigga, or 376lbs. per acre; and this of clean cotton such as I send you."

The Secretary said he had referred this sample to the Cotton Committee, who had reported as follows :—

Minute by Mr. A. Stirling.—I have examined this sample ; it is very clean, and the staple is firm and silky but soft, and appears to me to have been over-ginned and damaged in the process.

Minute by Mr. M. Henderson.—This is a very nice silky description of Cotton, clean and of good staple, and well up in length and strength of fibre to the best parcels of Hingunghât. The staple I think has been slightly injured in the process of cleaning, but this defect could be easily remedied by the use of an improved gin. Such a class of cotton would sell readily in the home markets at a rate approximating to the value of mid-New Orleans.

Minute by Mr. J. M. Ross.—My impression is also that the cotton has been over-ginned and staple spoilt. The mean length of staple of the sample submitted is not over 1 inch, whilst the average of Hingunghât grown is nearly 1·40 mean measurement. The cotton is otherwise a valuable product. I concur in Mr. Henderson's valuation.

Tobacco.

Read the following report by Dr. C. Fabre Tonnerre on the sample of Tobacco raised in the Dilkoosh Garden of the Maharajah of Burdwan, from James River Virginia seed, which was presented at the last meeting :—

"I have the honor to report for the information of the Society, that I consider the tobacco submitted by the Maharajah of Burdwan as a most superior article, and in my opinion equal to the best Brazil tobacco. It is excellent for smoking purposes. I have prepared a portion of it like the American tobacco, and the two samples accompanying this report are equal to the best Cavendish tobacco imported from America. Very good cigars could also be manufactured from the leaves. In its present state it would realise from ten to twelve rupees per maund in the

bazaar; but if the leaves were better prepared, the tobacco would command a high price in the markets of Continental Europe. I am of opinion that sufficient care has not been bestowed either upon the cultivation or the process of gathering and drying of the leaves, most of which appear to have been plucked in an unripe state.

"To obtain a good produce, the ripe leaves ought to be gathered on a dry day between the hours of 10 A.M. to 5 P.M. No leaves ought to be plucked unless they show a yellow tinge, approaching to brown or Sienna color. The delicate leaves of the upper portion of the plant can be gathered when of a light yellow color, but on no account ought green leaves to be plucked, as invariably they give a bitter flavor to smoking tobacco.

"The tobacco leaves ought to be dried upon *machans* under the shelter of a roof made of *hooglah* or some other light material, and freely ventilated.

"The process suggested by me for curing the leaves is so simple, that it can be adopted by the poorest ryots without much expense. In fact it would more than repay them for the trouble.

"The reasons for saying that sufficient care has not been bestowed upon the cultivation of the tobacco are, that the leaves are not as broad as they ought to be and that the ribs are coarser than those of Virginia tobacco cultivated either in South America or in Europe.

"The soil of Bengal appears to be most suitable for the cultivation of finer kinds of tobacco than those exhibited at the Alipore Agricultural Show."

Resolved—That a copy of this report, and a portion of the manufactured article, be forwarded to the Collector of Burdwan for submission to the Maharajah.

Read also the following letter from Mr. D. Bruce of Gowhatty, Assam, respecting the sample of tobacco alluded to under the head of contributions:—

"I have pleasure now to report on the result of the experimental cultivation of the Virginia and Havannah seeds sent by you. The seeds were sown immediately on receipt, which was about the end of January, and the young plants transplanted about the beginning of March. They throve remarkably well, the Virginia rivalling the Rungpore in size, but unfortunately from the time that the leaves showed indications of ripening, we had such heavy showers of rain, that the land got deluged and the plants destroyed, except a few Havannah that had early ripened. A few leaves as sample I will send by the next steamer that leaves this place. As I have been unable to keep any seeds, owing to the adverse circumstance spoken of, I hope you will be able to send me a supply and early, otherwise it would not be worthy a trial in a climate like Assam where the rainy season commences earlier than in Bengal. I don't think you will find the tobacco of the desired strength and flavor; but considering that it was raised during the rainy season, it must be admitted to be a fair sample, with a promise of being better if sown in the proper season, and no adventitious cause occurring to prevent it."

Dr. Tonnerre reports as follows on this tobacco :—

"The second or Assam sample submitted for examination, seems to be well cultivated; the leaves are well cured and dried, but they are coarser than the leaves of the Virginia tobacco cultivated in Europe. I found it deficient in flavour; this defect is no doubt owing to climatic influences which, it appears, were most unfavorable, after the plants had acquired a certain growth. I would suggest, should Mr. Bruce continue to cultivate the same tobacco, that he send the Society a larger quantity so as to enable me to ascertain its value in the market and also to have a certain portion manufactured in Calcutta. Nobody at present can prudently commit himself to fix any price on the tobacco, owing to the smallness of the sample, which consists apparently of fifteen picked leaves."

Cochineal.

The subject that next came before the Meeting had reference to Cochineal, in the shape of a letter from the Honorary Secretary of the Mysore Agricultural and Horticultural Society, who writes as follows:—

"Should there be in the Government Gardens or Horticultural Gardens any plants of the true Mexican Cochineal Cactus, *Opuntia Cochinillefer* and *Opuntia Tuna*, or kinds so called, may I ask you to send some plants in a Wardian case by the next steamer from Calcutta to my address, care of Messrs. Binny and Co., Madras. There is a Cactus in the Bangalore Government Gardens called the O. Cochinillefer, but I have my doubts of its being the correct kind, and comparison with your specimens will be useful, as also to have your variety to grow. I purpose again trying to introduce the true Grana Fina Cochineal insect cultivation here.

"If any more recent attempts at true Cochineal culture have been made in your part of India since those mentioned by Dr. Royle in his work, the "Productive Resources of India," page 57, could you give me a guide as to where I may find the record? It appears that the experiments made nearly 100 years failed because the wrong insect was introduced, and probably also the wrong kind of cactus. A gentleman recently introduced the true insects, but he had no cactus food for them after their arrival here, and they died. He did not know of the cactus in the Bangalore Government Gardens that I have alluded to, and so the chance of trying that cactus was lost."

The Secretary mentioned he had been able to meet the request of Colonel Boddam, through the kind assistance of Mr. Scott, the Curator of the Royal Botanic Garden, who had supplied him with cuttings of what he considers the true *Opuntia Cochinillefera* and *Tuna.* He (the Secretary) had also referred Colonel Boddam to the sixth volume of the Transactions, shewing what the Society had attempted towards the introduction of the domesticated Cochineal insect *(Grana fina)* since the publication of Dr. Royle's work.

The Secretary next read a communication from the Secretary to the Chief Commissioner of Mysore forwarding copy of a letter from the Honorary Secretary, Mysore Agricultural and Horticultural Society, and enquiring if any attempts had been made to introduce the growth of Cochineal in the Bengal Presidency.

It was agreed that Colonel Boddam's remarks be introduced in the Proceedings of this day's Meeting. They are accordingly inserted as follows:—

"I have the honor to request you will submit the following to Colonel Meade in view to enquiring whether any attempts have been made to introduce the growth of Cochineal in this Province (Mysore).

"It is not generally known that of late a great increase in demand for the article has arisen.

"Brazil and Mexico have always supplied Great Britain with large quantities, but of late years Cochineal has been largely cultivated in Madeira and the Canary Isles, and during the past year many new plantations of Cochineal have been established in Teneriffe and the neighbouring isles, in all of which the cultivation is proving most remunerative, a large amount of capital being thus employed. So great indeed is the demand in Europe for this valuable dye, and so large the profits derived from it, that every available piece of land on the islands is being laid under cactus cultivation for production of Cochineal. So much so, that every other branch of field produce is suffering, even the cultivation of good plants both for human consumption and for cattle is being neglected, the temptation of realizing such large returns from Cochineal crops causing landholders to neglect proper care of the soil suitable for growing other plants.

"Several species of Opuntia (Cactus) serve as food for the Cochineal insect, though *Opuntia Cochinillefera* and *Opuntia Tuna* are the most commonly used. There are several varieties of Cochineal insect, an inferior kind, abounding in Bengal, but the Cochineal of commerce is the "Grana fina" of South America, and I cannot learn whether it has been ever imported or had a fair trial. The question occurs to me whether any part of the Mysore province would do for Cochineal culture. Any kind of cactus, I believe, would grow here, and a great many of the Flora, &c., of Brazil and Mexico, do well at Bangalore. We have also marked and regular seasons."

In reference to the above letter of Colonel Boddam the Secretary remarked that though the wild species, *Grana sylvestra*, abounded in various districts of Bengal, no attempts had been made, of which he was aware, to improve it by careful culture and judicious management. This wild insect has been found, by ordinary culture, to yield a color equal in brightness to the domesticated Mexican species, or *Grana fina*, but it does not yield more than one-third of the coloring matter. As several attempts to introduce the *Grana fina* into Bengal had failed, owing to unsuitability of climate, efforts might now be directed towards improving our own indigenous sort. From correspondence which was published by the Society twenty

years ago, certain portions of the N. W. P. and the Punjab would appear to offer a fair field both for the improvement of the indigenous kind, and for the introduction of the Mexican variety. The experiments of the late Dr. Dempster on the wild Cochineal of Upper India and the Punjab, and the observations thereon of Drs. Falconer and McClelland, which are recorded in the seventh and ninth volumes of the Journal, will be found alike instructive and interesting.

CHINA GRASS.

Read the following extract of a letter from Mr. James Montgomery, of the Ram Bag, Kangra, in continuation of the remarks submitted at the last Meeting :—

"I have much pleasure in acknowledging your favor of the 25th ultimo, and am glad to find that you consider the China-grass fibre prepared by me to be of good quality. In a letter from a dealer in England, of 21st July, I am informed that my fibre is £20 per ton better than any then in the market.

"I cannot at present send you any seed. My plant has been cut twice this year, and I am now cutting it the third time. A few old clumps have however been left, and should they ripen any seed in October, it shall be saved for you. I enclose a few 1868 seeds, but these are now useless. I have noticed that very dry seasons are favorable to perfecting the seed. Last year was an exceptional one in this respect, and the plants were loaded with seed. This year has been the reverse, 72 inches of rain having fallen since 14th June.

"Full-grown leaves on my plants measure 12" × 17". I have often endeavoured to dry specimens, but cannot preserve them in their natural color, the upper surface invariably turning more or less black; so sending you leaves would not be of much use. I have posted for you a piece of root, and if you will have it planted in your garden, it will, in a very short time, enable you to examine the fresh leaf. That the "Rheea," and "Bœhmeria nivea" are of the same species, there can be no doubt; but whether direct comparison would show a difference sufficient to authorize their being considered distinct varieties, I am not in a position to judge. There are two varieties found in the hills in this vicinity, which, when growing, and at a short distance, I can scarcely distinguish from my own; yet close examination shows marked differences between the three.

"It is very probable that most, if not all, the specimens sent to you from the Punjab were obtained from me. So far as I can ascertain, until I introduced the plant in 1863, few in Upper India had seen either it or its fibre. Since then I have supplied roots to the Lahore and Saharunpore Gardens, and to a number of private individuals. No fibre has yet been shown me superior or even equal to my own, nor has any reached England. I am now preparing a quantity for transmission to England, and will send you a fair sample from the bale for your own inspection and that of the members at any of your Meetings. Should a better specimen be sent you, I shall esteem it a favor if you will send me a small portion."

The seeds referred to in the above letter are bad, but the root is sound, and Mr. Scott, who has kindly undertaken to raise it, reports that it is pushing out shoots vigorously. Though the plants (Rheea) flower annually in the Botanic Garden in the hot season, they never produce a single seed. The introduction of this root from Kangra will enable a careful examination to be made hereafter between the Rheea and this other stock which Mr. Montgomery reports having raised from seed imported in 1864, from China direct.

Agricultural and Horticultural Notes.

Submitted the following interesting remarks from Lieutenant J. F. Pogson, in reference to Rice, Potatos, &c.:—

"I do not see the *Field* newspaper, but the subjoined extract therefrom which appears in the *Delhi Gazette* of the 25th August, is deserving of attention:—

"'The Chinese assert that the rice imported from other countries where manure is not employed, is so inferior to their own in food-giving properties, that three bowls of it are required to satisfy a hungry appetite against one of the home-grown variety. In Japan, however, the soil is so superior to that of China, that the rice produced in it is not liked by the Chinese on account of its extreme richness.' Further on it is stated—'The yield is said to be sixty bushels of rice per acre,' *i.e.*, China rice.

"That the rice of China contains more gluten than Indian or American rice is quite possible, and that the rice of Japan contains more than that of China, is proved by the fact of its 'extreme richness.' The best Carolina and Patna rice only contains 7½ per cent of gluten and three-fourths per cent of fat, and as the nourishing powers of a cereal depends on its richness or gluten, and fat, the rice of Japan must contain both in excess, to be condemned on account of its richness.

"There is no accounting for taste, and as the Japanese have for ages thriven on the very rice condemned by the Chinese, I suspect the glutinous nature of the Japan rice is what is objected to. But be that as it may, it is quite clear that the Japanese possess a very superior description of rice, and that the Chinese have a variety far superior to ours. Under these circumstances, I would venture to suggest for the Society's consideration that it would be advisable to give both kinds a trial in India. The land being reclaimed from the Salt-water lake, would be a very good site for the experiment, and the sale of the produce as acclimatized seed would yield a no small income to the town of Calcutta. My experimental plot of Carolina rice is flourishing, 43 inches being the highest growth, and 33 the lowest. No signs as yet of the ears of rice, but they cannot be far off.

"You sent me two kinds of Lall Sag; the real or red kind has maintained its usual growth, but the other kind varies in height from 32 to 63 inches, and is laden with seed. The leaf of this sag, when cooked, gives a pale pink color to rice, and is not near so palatable as the true 'Lall Sag.' It is I think of

value for its seed, which the Paharrees say they could make into flour, and eat as they do the '*Bhatie.*' Goats and rabbits eat the leaves greedily, and the porcupines enjoy the thick juicy stems; these are from three to five inches in circumference six inches from the ground.

"As this *sag* has grown so well in very poor rocky soil, and has not suffered from either the drought, or subsequent heavy rains, its value as cattle-food becomes apparent, and as such I would recommend it to all residents in Hill-stations who keep cows, goats, and rabbits. The seed no doubt will answer for fowls and pigeons.

"The incessant rain has prevented me from sowing the black poppy. I have tried the German method of potato-planting, and find that a single potato planted entire has thrown out stems and branches which actually take up 20 square feet of soil. The growth east and west being five feet, and north and south clear four feet (the flower branch is 3 inches over 4 feet, but I do not count this) and as the plant is in full flower and will yet grow for the next 30 days, it is pretty conclusive that the German farmers are right and the English wrong.

"My next potato experiment is also of importance.

"On the 9th July, I put down a large potato (crop of 1869) which germinated and was in leaf on the 25th July; since then its growth has been very vigorous (present height 18 inches), the flower buds having formed on the 23rd of August, and as far as I can judge the roots will be ready for digging up, with the main crop, which was sown in March. If the return is good, an opium or onion crop might safely precede the potato crop in the hills, and in gardens early vegetables of all kinds might form the first crop and potatos the next."

Read also the following extract of a letter from Mr. T. E. Ravenshaw, of Cuttack, respecting a blight in his rose trees:—

"All my rose plants this season have suffered from a peculiar scale or blight, which if not mechanically removed by a brush or scooping with a knife invariably kills the plants. It begins from below attacking the joints of shoots, and extends upwards by degrees All applications I have tried—tobacco water, lime water, smoke, carbolic acid water, and sulphate of iron and water have failed to stop the blight, or if the blight be killed the scales remain, and unless very carefully removed, the plants die. Examined with a microscope each scale contains a nest of minute insects. Can you tell me of any remedy for this pest? I enclose a specimen on a small scale; but large healthy plants become speedily covered."

The Secretary mentioned that Mr. Scott had obligingly favored him with certain remarks on the above which he would read, as most probably they would be useful to other amateur Floriculturists suffering from the same blight as that to which Mr. Ravenshaw alludes:—

"I have read Mr. Ravenshaw's note and looked at the specimen sent. I find it covered with one of the scale insects, which is not unlike that only too prevalent at times in roses in Europe, and there called the Rose Scale—*Aspidiotus*

rosæ. All the race are most serious pests, and most difficult to suppress when once it has been introduced into a collection. In Mr. Ravenshaw's case, it will be best to cut at once as much of the affected parts as can be spared, and rubbing the remaining parts with a handbrush, and washing with soap and water. I have also seen spirits of tar used with good effect, but this should be applied while the plant is in a dormant and leafless state. This is a winter's application in Europe : here I should recommend its being made about the close of the rains, after they had been subjected to their annual pruning. Mr. Knight recommended, for the destruction of scale insects generally, a dressing with lime and sulphur."

Mr. C. E. Blechynden, in a letter from Tirhoot, dated 19th September, writes as follows:—

"The seeds are splendid; all that I have yet sown have germinated 100 per cent. Marjoram, Basil, &c., difficult to get to sprout, are all out. I make it a point to put my packet of seeds in the sun, brown paper and all, whenever it is clear; this is good for them I should say, at least I have found it so. I shall be able to send down some good specimens of country Maize as grown by me. I picked the seed last year, and am rewarded by a very fine crop both as to quantity and quality: it is now being cut. What you sent me sometime ago, a small parcel, germinated well, but has not given good ears. I have found this to be the case with all the imported kinds the first year; as an instance, last year you sent me some Maize seed; the return was poor in the extreme. I got a few seeds; these, this year, have yielded beautiful ears. I will send specimens; the quality does not seem to have degenerated. The Brazilian grass (*Panicum spectabile*) is now five feet high, and has thrown out a number of shoots giving signs of flowering."

MISCELLANEOUS COMMUNICATIONS.

The following letters were likewise submitted:—

1—From Mr. F. Halsey, offering his services for raising vegetable and flower seeds for the Society at Umritsur for next season. Agreed—That Mr. Halsey's kind offer be thankfully accepted.

2.—From the Consul General, U. S. A., applying for a quantity of seed of *Papaver somniferum* for the Tenessee Horticultural Society.

The Secretary mentioned that he had been able to meet this requisition through the kind assistance of Mr. Robert King, of the Opium Department at Arrah.

3.—From the Secretary, Government of Bengal, P. W. D., Irrigation Branch, returning thanks for 40 copies, furnished to his department, of Rice Statistics of

4.—From Dr. W. G. Clarke, E. I. Railway, Medical Department, intimating that he has been successful in raising the Brazilian grass at Toondla, from seed received from the Society.

5.—From Mr. Claude J. Dumaine, the first portion of a "list of timber trees and useful plants of the Hazareebaugh zillah forests."

6.—From Mr. T. Sandys, a printed description of the machines and processes prepared by him for separating the fibre and bark of Rhees from the stem, and the fibre from the bark.

For the above contributions and communications, the best thanks of the Society were accorded.

Friday, the 28th October 1870.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:—

Messrs. W. J. Herschell, Thomas Chennell, E. M. Slater and F. Eisenlohr, Capt. R. J. Walker, the Maharajah of Tipperah, Messrs. Ralph Griffith, A.B. Sutherland, A. C. McFarlane, E. Lamb, and R. T. Hobart, Rajah Bejoy Kesub Roy Bahadoor, and Lieut. G. Alexander.

Corresponding Member—Dr. George King.

The names of the following gentlemen were submitted as candidates for election :—

Major the Hon'ble W. M. Fraser, Humeerpore,—proposed by Mr. H. A. Harrison, seconded by the Secretary.

H. D. Chauntrell, Esq., Solicitor,—proposed by Mr. S. E. Collis, seconded by Mr. J. A. Crawford.

Lieut. C. S. Noble, Asst. Settlement Officer, Fyzabad,—proposed by Mr. A. G. Grote, seconded by the Secretary.

H. F. Wilson, Esq., Serajgunge,—proposed by Mr. D. T. Shaw, seconded by Mr. T. F. Hamilton.

H. J. Dessa, Esq., East India Railway, Arrah,—proposed by Mr. H. C. Levinge, seconded by the Secretary.

Baboo Vinialacharand Bhuttacharjea, Deputy Collector and Magistrate of Nowada,—proposed by Baboo Protab Chunder Ghose, seconded by Rajah Suttyanund Ghosal Bahadoor.

Rajah Poorno Chunder Roy, of Sonaputty,—proposed by Dr. R. F. Thompson, seconded by the Secretary.

Rejoined—Capt. W. C. Mackinnon, Dum-Dum.

The following contributions were announced :—

1.—Report on the progress and condition of the Royal Gardens at Kew during the year 1869,—from Dr. Hooker, C.B., Director.

2.—Correspondence relating to the cultivation of Silk in New South Wales,—from Dr. Geo. Bennett.

3.—The Annals of Indian Administration in the year 1868-69, Part 1, Vol.

XIV,—from the Government of Bengal.

4.—A large quantity of "Brazilian Grass" seed *(Panicum spectabile)* raised at Dum-Dum,—from Colonee E. H. C. Wintle.

5.—A basket-full of Tomatoes, of a pear shape, raised at Seetakotta on the Chord line,—from Mr. F. R. Browning.

These Tomatoes were much admired for their rarity and pretty appearance. They are more fruity than the ordinary kind. Mr. Browning does not mention from whence he obtained the seed. He has promised seed for distribution.

6.—Another and larger sample of China Grass raised at Kangra,—from Mr. James Montgomery.

Mr. Montgomery sends this fine sample in continuation of, and as corroborative of his remarks which are published in the Proceedings of August and September.

Read the following extract of a letter from Mr. Grote, dated London, 21st September, in reference to the Picture and Address voted to him by the Society :—

"I have paid £11-11-4 to Grindlay, whose receipt I enclose. The portrait would have been packed for dispatch before now had I been in England when the Exhibition closed. *Now* I find that Mr. Knight is absent from London, and his studio is not accessible. I shall give orders for its dispatch when Mr. K. returns. I saw Mr. Robinson on his arrival, and duly received from him the frames with the address, which I admired exceedingly, and which I have deposited for the present with Dr. F. Watson in the India Museum. I feel deeply obliged to your Society for the trouble they have taken in having this flattering document so handsomely and elaborately recorded. The work does great credit to Mr. Locke's school. Pray give him my best thanks for his share in turning out this artistic memorial, which to me is specially valuable as containing the autographs of so many of my old friends."

SILK.

Read the following communication from Captain Thomas Hutton regarding the present state of Silk culture in India, with a few remarks on certain kinds of Silk yielders:—

"At a time like this when, through the state of misrule existing in China, vast numbers of the mulberry trees have been destroyed, and the culture of Silk has been greatly impeded,—when France is being desolated by war, and her cultivators are called upon to relinquish sericulture and draw the sword in defence of the country,—it would seem to be a fitting time for the Government of India to step forward and seize upon so favorable an opening for extending the cultivation of Silk. Upwards of a year has elapsed since the Duke of Argyll called upon the present Indian Government to exert itself in giving aid to the views and wishes of the Silk Association in London, and yet, with the exception of calling for information from all parts of the country from persons many of whom had probably never examined a caterpillar in their lives, we appear

to be just as far from aiding and improving the culture of this valuable article as if there were really no room for improvement.

"The misfortunes of China and of France should be regarded as most fortunate events for our own country and for India, and the Government should now promptly seize the opportunity of striking while the iron is hot. It appears to me that under existing circumstances there are just two courses open to us, namely, either to enter heart and hand into the task of extending and improving the Silk culture of the country, or to let things go on as they are until, as lately in France, the worms die out altogether and sericulture in India becomes a thing of the past. The present condition of all the Bombyces, and the frequent failures of the bund, especially as regards *B. textor*, furnish ample evidence that it is high time the Government should liberally step forward to arrest the downward progress of this branch of commerce, and restore the constitutional vigour of the worms by breeding them in more favorable climates than that of Bengal; and annually distributing both cocoons and eggs to those who may be willing to cultivate them on common-sense principles instead of handing them over to the natives to be again destroyed. There are men in the country who are perfectly willing to devote their time and attention to sericulture, provided they can obtain assistance in procuring species and a few judicious hints for their guidance. The expenses incurred by the Government in establishing an experimental Silk Farm for the purpose of issuing such healthy supplies of seed, would soon be amply compensated for by the increase and superior quality of the Silk produced for exportation from healthier stock.

"As regards the health of the insects now domesticated in Bengal, it is a well-known and oft-repeated fact that all are gradually degenerating; and what the wonder when we consider the remarks lately made by Mr. G. DeCristoferis on the Japan Silk worm, namely, that 'no annual worms will hatch regularly unless 'they submitted to the changes of the four seasons in a *temperate* climate from 'the heat of a summer to the cold of a winter below zero.' This is rather running to extremes, for I never resort at Mussoorie to any artificial means of protection, neither in this climate is it at all necessary to do so. Eggs and cocoons alike remain suspended in the same room, in which, taking the whole year through, the thermometer may occasionally rise as high as 82°, and fall as low as 26°. I have never found any irregularity in the hatching, unless like these Japan worms they were very unhealthy, or were naturally bivoltines converted, like *B. textor* of Bengal, into annuals. As to keeping 'the eggs well protected from the air *in an earthen pot*,' for fear of their hatching at unseasonable times, the practice is quite sufficient to show how thoroughly unsuitable and injurious to the constitution of the worms is the climate of Bengal, and how artificial is the treatment of the eggs, since exclusion from air is one of the very best methods of rendering the eggs sickly and unprolific. How would Mr. DeCristoferis thrive, if shut up in a small room from which all air was studiously excluded?

"The so-called monthly worms of Bengal are likewise showing signs of deterioration, but I strongly suspect that this is less the fault of the climate than the vile native methods adopted in rearing them. With respect to *B. textor*, Mr. C. S. Turnbull of Ghuttal informs me that 'the bunds for the last two years have been a failure' in his neighbourhood, and he adds, when kindly sending me some seed of this species, 'perhaps it may interest you to find out the cause.' This I shall certainly endeavour to do, for the eggs appear to me about half the size of those sent to me from the same locality about five or six years ago, and prove that the worm is already well on the road to ruin. I do not despair of being able to restore it, and even the Japan worm, I feel confident, will prove next year a very different worm from what it is at present, although some of the worms are even now 2½ inches in length, or as large as the Boro-pooloo of six years ago. The cocoons are by no means to be despised, being well formed, compact, and pale sulphur coloured. The Japan worm will doubtless thrive up here, although it will not submit to the suffocating pot-and-pan system of Bengal.

"Of the worm discovered last year by Mr. R. W. King at Ranchee, Chôta Nagpore, feeding on the *Artocarpus lacoocha* I think I may pronounce it to be *Bombyx Bengalensis*, discovered by Mr. Grote on the same species of tree, but he has figured it so incorrectly that no one could recognise the larvæ of Ranchee in the published figure of *B. Bengalensis* Mr. R. Frith of Calcutta told me many years ago that he had taken a moth which he considered to be *B. Huttoni* of Westwood, as he found it in mulberry fields near Moorshedabad, and could see no difference in the markings. In this he was perfectly correct, though the species are proved to be distinct by the difference exhibited by the larvæ. So closely allied to *B. Huttoni* is it, that had I not known from whence it came, I should have been tempted to pronounce it a diminutive specimen of that mountain species.

"When the cocoons arrived from Ranchee I found that many of the moths had come out and had laid their eggs; these in a few days produced small black caterpillars resembling those of *B. Huttoni* at that stage. The puzzle now was how to feed them, for there were no *Artocarpus lacoocha* trees nearer than the Doon, so I tried several wild figs—*Morus Sinensis*, *M. nigra*, *M. multicaulis*, &c., none of which would they touch, and I expected to lose the brood. At last I bethought me of *Morus Indica*, and succeeded wonderfully, the young leaves being riddled into sieves in a very short time, and from that moment I reared the brood on branches of this tree placed in jars of water. During the first stage the worms were just as intractable and wandering as those *B. Huttoni* and required incessant watching, but at night they remained quiet. A good crop of cocoons was secured, from which the moths again emerged, the worms from which are now feeding and thriving upon young mulberry trees in the open air. When the second brood of worms came forth, the leaves of *M. Indica* had become so hard and tough that the young insects entirely refused them, so I substituted leaves of *M. nigra* and *M. multicaulis*, which they readily ate, and on which they are now thriv-

ing. The Silk in colour resembles that of *B. Huttoni*; the cocoon is small, but well-formed, and the Silk strong and elastic, and I see no reason to doubt its utility. A full description in all its stages I reserve for another paper. Another species has lately been brought to my notice, which I suspect will prove new to science, and from the description it would appear to belong to the genus *Autheræa;* but of this more when I have seen the species.

"This shows that we have still a fine field for research before us, if we can but induce the Government to come forward to our assistance; and, in order to avert the impending wholesale destruction of our present stock, an experimental Silk Farm situated in a temperate climate, and under the liberal auspices of the Government, is all that is necessary.

"This system I have advocated and urged for the past twelve months but without any good result, and I am beginning to grow heartily sick of the subject, for few things are more annoying to an energetic mind than constantly bawling into the ears of those who either cannot or will not hear and understand."

"*P. S.*—In continuation of the above I may now add, that last night, 9th October, I received a letter from the Government declining '*at present*' to enter into the extension of sericulture; so after a correspondence extending over 12 months, and furnishing all the information called for, I am cast aside, and sericulture may go to rack and ruin.

"The words '*at present*' may lead to the supposition that the subject may hereafter be renewed, but it may not then be very easy to find a practical hand to carry on a Silk Farm, for certainly I will not do so unless on my own terms. I am sorry to say, therefore, that I must abandon my intention of publishing a work already in hand, the letter-press of which would have formed a manual of instruction to beginners, while the plates would have contained colored figures of every known species of Indian Bombyx, and with the caterpillars in the first and last stages of growth, the cocoon, and perfect insect both male and female.

"It is obvious, however, that such a work would be expensive, and that, without the aid of Government, far beyond my private means.

"Hence the scheme falls to the ground. Not only will the young sericulturist be deprived of a practical guide but scientific men in Europe will regret to lose figures taken from the life, and some of which have never yet appeared.

"Such, however, is the decree of fate, and my career as a scientific sericulturist must cease."

The Secretary mentioned, in reference to the first portion of the above letter, that no reply had yet been received from the Government of India to the letter of the Society forwarded in March last with the Report of the Special Committee on the present state of Silk Cultivation in Bengal.

Report from Sydney on Assam Silk Worms' Eggs.

The Secretary next read the following letter from Dr. Geo. Bennett, Honorary Secretary, Acclimatization Society of New South Wales, and submitted the report

from Mr. Brady on the condition of receipt of a packet of eggs of the Mezankoory Silk worm of Assam *(Autheraea Assama)*, forwarded in July last:—

"I received your letter of the 30th of June, and have sent you by Book-Post, this mail, the correspondence with India respecting Silk, printed by the Colonial Government and presented to both Houses of Parliament. Many persons in the Colony have been now induced to plant this season a large quantity of mulberry trees of the most suitable kinds, preparatory to the cultivation of Silk, this will give an impetus to the exertions of the Society, who having succeeded in already introducing the best kinds of worms, and as the report of the grain sent to Europe by Mr. Brady (as you will see in the correspondence) has been acknowledged to be of a very superior quality, the Society are now disposed to rest from any further importation of worms of any kind until they see what success attends those at present in their possession, or whether the Colonists will enter with energy into the cultivation of this important industry, for which the climate of New South Wales is so suitable. In the interval the Society would feel obliged if you would kindly inform them what amount would be required to be remitted to meet the expenses attending the introduction of other varieties and species of Silk worms, which will enable them to ascertain how far the funds of the Society (necessarily limited) will enable them to avail themselves of the opportunity offered, unless the Society could induce the Colonial Government to assist them in so laudable an object.

"I have also received by this mail your kind letter of the 29th of July, and also a packet containing eggs. Mr. Brady, to whom I sent them, has given me a letter reporting upon them, which I have enclosed, with many thanks for your attention.

"GEO. BENNETT, ESQ., M.D.,

"*Honorary Secretary, Acclimatization Society of New South Wales.*"

"I have received the package containing eggs of the Mezankoory Silk worm just arrived by the mail, for which we are indebted to Mr. Blechynden.

"Upon examination I found the grain in good order, except that the eggs had become loose from the sticks, and (the bottle having been hermetically sealed) the sweating had been excessive; a fair proportion of the seed appears very good, and I think the vitality is unimpaired, but in future it would be well not to cork or seal the bottles. In my opinion the best stopper is a piece of muslin, or thin stuff, stretched tight and tied over the wide mouth, this allows sufficient air to pass to sustain the embryo and prevent fermentation; in this instance the stink in the bottle was very strong.

"I shall carefully watch the progress of this new lot, and, in due time, let you know how they get on.

"CHARLES BRADY."

BRAZILIAN GRASS.

The Secretary mentioned that it would be in the recollection of Members that Dr. Hooker had kindly responded, about a year ago, to the Society's requisition for the seed of the "Brazilian grass (*Panicum spectabile,*)." and that, as reported, at the June meeting, it had been distributed to upwards of 50 applicants; but that so much greater had been the demand than the supply, that he had applied to Dr. Hooker for a further quantity. By a letter received by a recent mail, Dr. Hooker had expressed his readiness to write for more seed, if it was certain that it is the seed of *Panicum spectabile*, as to him it now appears only a variety of Guinea grass. (*P. jumentorum*).

Colonel Wintle had received a small portion of the seed in question, and now submitted the result in the several bags of seed placed on the table, with a specimen of the grass. In his letter accompanying this donation, Colonel Wintle remarks:—"It is a splendid plant and I think of quicker growth than Guinea grass, especially in the dry season; in the wet I do not think it thrives so well." Colonel Wintle also observes that he finds it of a much more branching habit than the Guinea grass he has been in the habit of growing. To set the question of its identity with Guinea grass or otherwise at rest, he (the Secretary) had forwarded this sample to Mr. Scott, the Curator of the Royal Botanic Gardens, who reports that he finds no difference between them.

Letters were also read—

From the Under-Secretary to the Government of India, requesting that the result of the experiments instituted with Compton's Patent Chemical Manure in the Society's Garden may be reported through the Government of Bengal, for the information of the Government of India.

The Secretary reported that the manure in question was received in January last and had been distributed in small quantities, to about thirty applicants. He had not yet received a single report, but had now written for them. No experiment had been instituted by the Society, as they had not been in a position to do so, and had, indeed, been obliged to suspend all such useful trials since the period the Government of Bengal had resumed the piece of ground which had, for so many years, been allowed them as an experimental garden.

From E. W. Molony, Esq., Commissioner of the Rajshahye Division, in respect to the Otaheite Sugarcane. "I have come to Rungpore on circuit"—writes Mr. Molony—"and am informed by an old resident here (Mr. Rehling, a Danish gentleman) that in former years the Government used to distribute to all applicants a superior kind of sugarcane called the "Otaheite." This cane was highly appreciated by the ryots, who still continually ask for what they call the Saheban cane. It was cultivated largely for many years, but has now quite died out.

"Could you kindly inform me whether the Society could supply me with any of this cane, or whether the Government have any in their garden which they

would give for propagation here. Mr. Rehling will take great interest in the first operation necessary to re-introduce the cultivation here."

The Secretary mentioned that the Society had distributed, in former years, not only in the Rungpore, but in various other districts of Bengal, large quantities of the Otaheite and other superior varieties of Sugarcane, but this, and other useful cultures, had necessarily been abandoned since the resumption of the Society's garden by the Government of Bengal. Mr. Scott, the Curator of the Royal Botanic Garden, is also unable to meet Mr. Molony's requisition.

From the Officiating Assistant Secretary to the Government of Bengal, submitting a further despatch respecting the collection of Ipecacuanha plants for India.

From Mr. H. A. Harris, in reference to his previous communication (submitted at the August Meeting) regarding irrigation by wind power. Mr. Harris acknowledges receipt of several responses, through the Society, to his offer of a small wind-mill pump, complete, on certain conditions, and then states as follows :—

" I now beg to inform you that my first model of a simple pump is at present working in the garden of the ' Presidency Jail,' and can be seen on application to Dr. Lynch, who has kindly taken charge of it, and is experimentalizing with it.

" I have a second model in hand, but have so little leisure time just now that I am afraid some delay will occur before it is completed. When ready I will again communicate with you.

" I will make drawings of my models and send you a few copies, and any person can then put up a pump himself; this will prevent delay and disappointment.

" I am happy to say that Government are going to move in the matter."

From the Secretary, Agricultural and Horticultural Society of the Punjab, returning thanks for a copy of the last published No. of the Society's Journal (vol. 2, Part 1, N. S.).

From the Secretary of the Madras Literary Society to the same effect. Mr. Grose promises to send as requested for the Journal any papers they may receive bearing on the rural economy of their Presidency, as they have for some time past ceased the publication of their Journal..

From the Secretary to the Chief Commissioner of Mysore, conveying the Commissioner's best thanks for the collection of grass seeds forwarded at their requisition.

For the above contributions and communications the best thanks of the Society were accorded.

Friday, the 25th November 1870.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:—Major the Honorable W. M. Fraser, Lieutenant C. S. Noble, Messrs. H. D. Chauntrell, H. F. Wilson, H. J. Dessa, Baboo Vinial Charana Bhuttacharja, and Rajah Poorno Chunder Roy.

The names of the following gentlemen were submitted as candidates for election:

Mohina Rungun Roy Chowdhry, Zemindar of Kakcma, Rungpore,—proposed by the Secretary, seconded by the President.

The Honorable A. Eden, c.s.,—proposed by Mr. R. W. King, seconded by the Secretary.

H. T. Prinsep, Esq., c.s.,—proposed by Mr. King, seconded by the Secretary.

E. F. Sandys, Esq., Chupra,—proposed by the Secretary, seconded by the President.

The following contributions were announced:—

1.—Memoirs of the Geological Survey of India, *Palæontologia Indica*, vol. iii., Nos. 1 to 4; Memoirs of the Geological Survey of India, vol. vii., Part 2; Records of the Geological Survey of India, vol. iii., Part 4,—from the Superintendent, Geological Survey of India.

2.—Cuttings of a few new kinds of Roses,—from Dr. T. Beaumont.

3.—A small quantity of acclimatized flower seeds,—from Mr. R. W. King.

4.—A few seeds of Australian Gum trees,—from Mr. John Hudson.

5.—Seed of Guinea Grass raised from the so-called Brazilian Grass seed,—from Dr. W. G. Clarke.

6.—Samples of Carolina Paddy raised in the Andamans,—from Captain Prothcroe.

The following notice from the Council was read (to be re-submitted for confirmation at the next Meeting):—

"That the Council of the Society be allowed to appropriate a sum not exceeding Rs. 30,000, out of the invested capital of Rs. 42,700, from time to time as required for the purchase of a piece of land in the suburbs of Calcutta, for erecting buildings thereon, for excavating tanks, and laying out such land so acquired for a garden for the use and benefit of the Members of the Society in the terms and conditions of Chapter V., Sections 1 and 2 of the Bye-laws."

Proposed by Mr. W. Stalkartt—"That no steps be taken towards the purchase of any piece of ground until the whole garden question is brought before the Government again."

Eggs from the Japan Silk Worm.

The Secretary next submitted the following remarks from Captain Thomas Hutton, relative to the result of his trials with Japan eggs:—

"Anent those Japan eggs sent by M. de Christoferis, I all along apprehended

a cross-breed! This turns out to be the case as formerly with those you sent me; yours was a hybrid between B. Sinensis and B. Mori, whereas these are a hybrid between B. Sinensis and B. Textor. It is easy to obtain a cross, but this is the first time I believe that the two species composing it have been so thoroughly separated. M. de Christoferis' eggs hatched in dribblets, and after a time showed two differently colored caterpillars, from the appearances of which I guessed the presence of Sina and Boropooloo; at length cocoons were spun, one beautiful yellow, the other whitish with faint yellow tint. The moths came forth one kind very small, and the other as large as Boropooloo. Then I made all the small ones couple together, and all the large ones together also: the small laid pale yellow eggs, which in ten days turned purplish and then grey blue; these hatched again, and the manner of hatching at once proved them to be B. Sinensis; as, instead of ceasing to hatch about noon as all the others do, they continued to come forth *all day and all night*, so that in 24 hours all were hatched: they are now feeding merrily, and gone through one moult. The large moths also laid eggs which were larger than the others, and in a few days turned vinous clay and then deep leaden grey, *but* not one of these has hatched, and they will probably remain in *statu quo* until the spring! Here then is the secret of M. de Christoferis' failure, for it was a case of the *Sina* striving to hatch, and the *Boropooloo* trying to remain unhatched, and so between them spoiling the brood. When *Sina* has again laid its eggs I will send you a few, as well as of Boropooloo, that you may see for yourself. France has trustworthy agents in Japan, and therefore I suppose procures an unadulterated article, whereas any one writing to a friend gets any hybrid that comes to hand."

Trial Sowing of imported Seeds.

The Secretary placed on the table a statement with which he had been obligingly favored by Mr. John Scott, Curator of the Royal Botanic Garden, of the result of sowings of the imported seeds of this season, vegetable and flower, and read the following note thereon:—

"I enclose a tabular statement of the results of my trial sowings of your vegetable and flower seeds. The results show the high quality of the seeds, and though a few (as shown in the tables) failed in the first sowing during the rains, in a subsequent trial I have got all to germinate, so that should you have complaints from Members the fault lies not in the seeds, but in the bad management of those who fail, should there be any."

The best thanks of the Society were tendered to Mr. Scott for his kind compliance with their request, and for the trouble he has taken in testing these seeds and preparing the tables.

Utilization of the stalks of the Cotton Plant.

Read a letter from Dr. R. F. Thompson, Civil Surgeon, to the address of the Magistrate of Hooghly, on the above subject. This letter, with the

specimens of fibre and gunny cloth therein alluded to, are forwarded to the Society by the Commissioner of Burdwan for an opinion as to their value and quality.—(*See Correspondence and Selections.*)

CAROLINA PADDY.

The Secretary read the following letters regarding the results of attempts at cultivating the Carolina paddy in various localities:—

First.—From the Officer in charge of the Maunbhoom Jail, to the address of the Inspector-General of Jails, Lower Provinces, dated 7th October 1870:—

"I regret to inform you of the almost total destruction of the Carolina paddy which was sown in the Jail garden in June and July last, and which looked so promising twelve days ago, when the Sanitary Commissioner saw it. During the last week an insect larger than the common fly, and of a color resembling the plant, attacked the crop and partially destroyed it. The natives call the insect by the name of *Bhowan*, and I have had a few of them caught and preserved in spirits of wine. The stench from the insect is intolerable, and cannot be easily removed from the hands by washing. It seems that the insects flitted about the crop in large numbers and settled upon the ears, from which they could not be driven off, and from whence they extracted the sap, or milky juice, and left a quantity of withering husks. It is very curious that the insect did not attack aught else in the garden, nor is it known to infest the common paddy crops of this place, except those that are grown early, and then very seldom. I procured the services of some cultivators of rice for the purpose of ridding the rice crop of the horde of flying insects, but their applications (consisting chiefly of assafœtida) failed to do any good.

"My private gardener, whom I brought down to the Jail garden, states that the presence of the insects was owing to the kind of manure used in the ground. This may be questioned, inasmuch as the same kind of manure is used throughout the garden, and no other crops therein have been similiarly affected either now or at any other time. Besides, such manure is partially used by native cultivators, who are only too glad to allow people to relieve themselves in their fields.

"The rice plant had attained the height of 3 feet and 10¾ inches, and each plant on an average contained 149 grains. The latter were larger than those seen in the indigenous rice crop, which was sown about the same time that we made our sowing."

In the letter forwarding the above report, Dr. Mouat requested to be informed if a remedy could be suggested. The Secretary mentioned he had, in reply, applied for a few of the insects referred to.

Second.—From J. D. Gash, Esq., of Jugdespore Factory, Pertabgurh, Oudh, dated 12th October 1870:—

"It was my intention to have sent you a detailed account of the results of my sowings of the Carolina paddy you sent me, but I am afraid I will not be able

to do so as the crop on the ground is being fast destroyed by a species of grub which finds its way in the hollow of the stalk, as also of a fly that attacks the ears as they first make their appearance; and the grub works its way up the stalk eating the coating of pith which lines the stalk, and the consequence is, the grains in the ear do not properly form but are destroyed in their infancy. The fly only confines itself to the unripe grains, and from all I can yet see, it seems to destroy the vitality of the grain by, as it were, sucking up the nourishment required to produce the paddy. As the success of my crop depends in a great measure on the destruction of these grubs and flies, I will feel obliged by your sending me, by return of post, any information you can for the extermination of these pests. I am at present trying oil cake, but am not certain of the success I will meet with. I send you a few of the destroyed ears, as also some of the flies and grubs; the flies have a bad smell as the native name implies. They are called *Gandhee*, and the grubs "*Kâra.*"

The Secretary mentioned that he had, immediately on receipt of the above pests, sent them to Dr. John Anderson, Curator of the Indian Museum, and he had been favored with the following reply from Mr. Wood-Mason, the Officiating Curator :—

"I must apologise for delaying so long the answer to your note of 15th October. My colleague, Dr. Anderson, left Calcutta on 25th October for Europe hence this delay. The grub referred to by Mr. Gash is probably the larvæ of some boring beetle, and the so-called fly certainly a species of bug: all the species of the enormous family *Hemiptera* (bugs) injure plants or animals in the way described by your correspondent. The insects arrived in such a damaged state that it would be impossible to attempt to give a more precise determination than the above. If Mr. Gash will kindly forward specimens of his enemies preserved in spirits, we shall be happy to give him more definite information; but, I regret to say, that we cannot hold out to him even the shadow of a hope of being able to find a remedy."

Third.—From S. E. Peal, Esq., of Sapakattee, Seebsagor, Assam, dated 12th December:—

"I had hoped to be able to report favourably of my Carolina paddy this year. not only as I have two acres or more of it, but from its fine healthy appearance. An unexpected pest, however, has appeared in the small birds, for as it is the first in ear by about a month, when once found out they never leave it.

"One small bird called the "Toonie" is the worst; it is useless almost to try to frighten it.

"At 10 or 12 feet off they sit and eat, and unless pelted will not stir; and as this remedy is worse than the disease, I now try shooting them.

"This latter I tried all yesterday but found it of little use either. They will alight in a cloud at the gun-muzzle. Being *very small* I seldom get more than two at a shot, and they must of course be shot flying. It is most disheartening, more

especially, as the Assamese now see the trouble and thank their stars they have *not* got this new kind.

"The native crop is not yet in ear, so this will continue for another 10 or 20 days.

"Yesterday I estimated about 4,000 of these birds alone that could not be kept off, and on opening those shot I found eight to ten grains of "milk rice" in their crops; this was the morning meal, and as in the evening it is worse, I imagine the loss daily was about 8,000 grains, and this will soon leave nothing.

"I was on point of writing to say I should have 10 or 20 maunds good acclimatized Carolina paddy to place at your disposal, but I am afraid I shall only save enough for seed.

"What is now growing came from some I planted last year at the usual (local) time.

"This Toonie is a grass seed-eater and does not roost in trees."

Fourth.—From Captain M. Protheroe, Assistant Superintendent of Port Blair, Andamans, dated 7th November:—

"I have the pleasure to inform you that the ten seers of Carolina paddy seed forwarded from Metcalfe Hall were duly received, and the crop was grown at Port Mouat, an out-station of Port Blair, under Mr. J. N. Homfray's superintendence.

"The seed was sown in a nursery during the last week in May, it was planted out in June and covered an area of about four acres. It ripened during the first two weeks of October, during which time we had dry weather, and the crop was then got in. The yield was a little over lbs. 7,000.

"I forward, favored by Captain Rundell, specimens of the paddy. The roots of the first crop have been left in the ground for a second crop.

"The above yield would have been much larger had it not been for the ravages of innumerable small birds, which were with great difficulty prevented from destroying the whole crop.

"The experimental crop having been successful this paddy will be tried on a larger scale next season."

Letters were also submitted:—

From Captain Thos. Hutton, Mussoorie, forwarding a note on the Burmese Silk Worm in reference to the report of the Deputy Commissioner of Thyetmyo on Sericulture in British Burmah, as published in the supplement to the '*Gazette of India* of 5th November, No. 43 of 1870.—Transferred for publication in the Journal.

From F. Halsey, Esq., Umritsur, in respect to the supposed Brazilian grass. "I beg to report," writes Mr. Halsey, "that the seed you sent me last year of '*Panicum spectabile*' has germinated freely. At the time you sent me the seed you expressed an opinion that it was the same as the ordinary Guinea grass of the country. I now beg to confirm that opinion without any doubt whatever. I have seeded both side by side, and to my mind they are absolutely identical. At the same time, it cannot be impressed too much upon people, that there is no better forage for cattle than this grass on irrigated lands,

and with a little manure occasionally it can be cut twelve times a year, and cattle are greedily fond of it."

The Secretary observed, in reference to the above remarks of Mr. Halsey, that seed of the Guinea grass had been distributed by the Society annually for the past 30 years or more, so impressed were the executive of the desirableness of introducing, if possible, this fine cattle fodder throughout India; but the object desired in the attempt (hitherto fruitless) of obtaining the Brazilian grass seed was to introduce a plant which, from report, is said to be *independent of irrigation.* The Guinea grass, when once introduced, can be kept year after year in Bengal without irrigation, but in Upper India constant irrigation would appear to be absolutely necessary for its preservation.

From Patrick Duff, Esq., Bhaugulpore, reporting the result of his trial with the Pegu Indigo seed received from the Society in January last. The following is extract of Mr. Duff's letter:—

"I sowed some portion of it in May, on the first shower we had, and finding it suffering for want of another shower, I watered it with a garden watering pot, but not getting any rain again for some days it seemed to be very much affected by the hot sun we were then having and died off. What remained I sowed with a crop of onions, a plan often followed in this district when practicable.

"The onions were watered, as usual, every week or 10 days, and under this treatment the Pegu seed seemed to thrive very well indeed. The plants when young had large leaves, but as they grew the leaves became smaller. The plants were not larger than those from Benares or daisee seed, and appeared very similar, except that the roots and branches were somewhat thicker than plants grown from the abovementioned kinds of indigo seed here. I do not think the Pegu seed will stand drought so well as Benares or daisee seed.

The quantity I got from you being so small I was unable to make experiments by sowing it at various times during the year; it might have proved better if tried in October, which month we all sow the greater portion of our indigo in. But, on the whole, I do not think it a better kind of seed than the two kinds I have had any experience with—that is, daisee and Benares. I did not find the leaf richer or in any way better than that of the above two kinds."

(This seed was presented by the Officiating Superintendent of the Royal Botanic Garden in December 1869.)

Mr. S. P. Griffiths remarked that he had also tried a portion of this seed by the side of the Purneah plant, and found the latter of a deeper green, and rather more luxuriant altogether, but there is not much difference between them.

From Captain H. P. Lovell, Superintendent P. and O. Company, intimating that he has received authority from London to refund half of the freight (£39-2-6) paid on seeds sent by Messrs. Law, Somner & Co. from Melbourne.

For the above presentations and communications, the best thanks of the Society were accorded.

A Special Meeting was held on Friday the 9th December 1870.

J. A. Crawford, Esq., *President, in the Chair.*

The President stated the object of the Meeting, and pointed out how greatly the efficiency of the Society was crippled for want of a piece of ground for an economic garden; he also alluded to the want of success which had attended the efforts of the Council to obtain a proper piece of ground, and the absolute necessity there was that the Society should have a garden to enable it to resume its former field of usefulness in agricultural experiments; and with this view, after briefly stating his own opinion in the case, suggested that the Society should address Government once more for the grant of a suitable piece of ground on such terms as might appear to the Meeting best adapted to obtain the object in view.

It was then proposed by Mr. A. H. Mowbray, seconded by Dr. C. Fabre Tonnerre, and *Resolved*, that the Council address the Government of Bengal for the grant of the piece of ground to the south of Belvedere, measuring about 41 beeghas, and offer, on the condition of the ground being granted in perpetuity, to forego the annual grant of Rs. 5,000 now paid by Government to the Society.

It was next proposed by Mr. J. A. Crawford, seconded by Mr. M. Henderson, and *Resolved*, that the Proceedings of this Meeting be submitted at the next Monthly General Meeting of Members for confirmation.

Tuesday, the 20th December 1870.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Monthly General Meeting, and of the Special Meeting of the 9th December, were read and confirmed.

The following gentlemen were elected Members:—

Mohina Ruengun Roy Chowdry, the Honorable A. Eden, Messrs. H. T. Prinsep and E. F. Sandys.

The names of the following gentlemen were submitted as candidates for election:—

G. Toynbee, Esq., Cuttack,—proposed by Mr. G. M. Currie, seconded by Mr. W. Macpherson.

Captain E. C. Corbyn, Deputy Commissioner, Shahpore, Punjab,—proposed by the President, seconded by the Secretary.

Moulvie Mahomed Russeed Khan Chowdry, Nattore,—proposed by the Secretary, seconded by the President.

W. Lloyd Jones, Esq., Bengal Police, Dinagepore,—proposed by Mr. Vesey Westmacott, seconded by the Secretary.

Baboo Goluck Chunder Ghose, Zemindar, Cuttack,—proposed by Baboo Mohes Chunder Banerjee, seconded by Rajah Suttyanund Ghosal.

Captain L. Blathwayt, Assistant Commissioner, Golaghat, Assam,—proposed by the Secretary, seconded by the President.

T. M. Francis, Esq., Solicitor, Calcutta,—proposed by the Secretary, seconded by Mr. R. Blechynden.

TRIBUTE OF RESPECT TO THE MEMORY OF DR. THOMAS ANDERSON.

Before commencing the ordinary business of the Meeting, the President in a few words alluded to the intelligence which had been received since the last Monthly Meeting, of the death of one of their Members, Dr. Thomas Anderson; and read the following Resolution, submitted at the last Meeting of the Council, which he was sure would be concurred in by every Member present:—

"That this Society has heard with the deepest regret the intelligence of the decease of Dr. Thomas Anderson, Superintendent of the Royal Botanical Garden, Calcutta. A worthy successor of Wallich, Griffith, Falconer and Thomson, he has been cut off in the prime of life ere the science to which he devoted himself could reap fully the benefits of his varied knowledge and matured experience. In him this Society mourns the loss of one of its late Vice-Presidents, and of a contributor to its Journal of many of the most interesting and useful papers in it. This Society takes, therefore, this the earliest opportunity in its power of placing on record in its Proceedings, its high appreciation of his services in the cause of botanical science, and the loss that this science has sustained in his early death." *Unanimously adopted.*

The following contributions were announced:—

1.—Report of the Sanitary Commission for Bengal for 1869-70; Report of the Cotton Department for 1868-69 and Records of the Geological Survey of India, vol. 3, Parts III and IV,—from the Government of Bengal.

2.—Progress Report of Forest Administration in the Central Provinces for 1867-68 and 1868-69; the *Flora Sylvatica* of the Madras Presidency, Parts II, IV, and V; and *Icones Plantarum Indiæ Orientalis* (Beddome), Series IV, V, and VI,—from the Government of India, Home Department.

3.—Report of Department of Agriculture of Washington, for August and September 1870,—from the Consul General, U.S.A.

4.—Annual Report of the Calcutta Botanical Garden, from April 1869 to March 1870,—From the Officiating Superintendent.

5.—Journal of the Asiatic Society of Bengal, Part I, No. 3,—from the Society.

6.—Cashmere Morels, by M. C. Cooke,—from the Author.

7.—Specimens of unusually large Capsicums and fine long Chillies (and a quantity of the seed) raised in Tirhoot,—from Mr. C. E. Blechynden.

8.—A few ears of "Japan Maize,"—from Mr. G. Bartlett. This is the maize with the white striped, leaf which is so ornamental.

The above seeds are available to Members.

RECOVERY OF DUES FROM EX-MEMBERS.

The attention of the Meeting was next directed to the consideration of certain practices occasionally resorted to by some few Members preparatory to resign-

ing, by which undue advantage is taken by them of their Membership, resulting in pecuniary loss to the Society.

It is, therefore, deemed expedient, for the better protection of the interests of the Society, to amend and enlarge the provision of the Bye-Laws, so that without having recourse to coercive measures, the Society may be enabled to recover some of the arrears of subscription and other dues from ex-members, and also prevent for the future a recurrence of the practices complained of—*viz.*, that of timing resignations after having fully-availed of the privileges of memberships, so as to evade payment of the last quarter's subscription for that year, and, in some instances, withdrawing from the Society by ceasing to pay any further subscription, leaving one or two quarters' subscription unpaid for the year in which they had exercised their privileges.

As every exertion is now being made to ensure the arrival of the seeds in all April for distribution next year, it is very desirable that the following Resolution, recommended by the Council, should be adopted :—

It was then proposed by Mr. W. Pigott, seconded by Dr. C. Fabre Tonnerre, and Resolved unanimously :—

"That a list of the names of all ex-Members who have directly and indirectly withdrawn from the Society by non-payment of subscription, &c., since the year 1868, after participating in the privileges of their membership during the year of their withdrawal, but who have failed to pay up the balance of subscription and their dues for such years, be published yearly from and after the 30th June next (1871) for general information."

Sericulture in Bengal.

Read the following communication from Mr. G. DeCristoferis in reply to the remarks of Captain Thos. Hutton, submitted at the last monthly meeting :—

"Permit me to address you a few lines for communication to the Society, in answer to some remarks reflecting on myself, made by Captain T. Hutton in his letter to the Agricultural and Horticultural Society printed in the *Englishman* paper of the 22nd instant.

"When I said that 'no annual worms will hatch regularly, unless they are submitted to the changes of the four seasons in a *temperate* climate, from the heat of a summer to the cold of a winter below zero,' I alluded to the Centigrade not the Fahrenheit. The climate of Mussoorie, ranging from 26 to 82 Fah. ought to be well adapted.

"In saying that the annual eggs of Bengal are kept well protected from the air in earthen pots (which are cool and porous), I was not advocating my own views, but was simply stating a method adopted by the natives of Bengal for the preservation of the annual worms, since perhaps these have been introduced in the country; and I fail to perceive the drift of Captain Hutton's comparison between a man and a silk worm egg, unless it is meant for witticism.

"Captain Hutton's plan of breeding the worms in a more favorable climate than Bengal, and then distributing both cocoons and eggs to those willing to cultivate them carefully, will do very well for the annual cocoons; but what is most vital in Bengal (where mulberry is cut four or five times during the year) and ought to attract the attention of all practical men, should be the improvement of the monthly or Polivoltine worm *in Bengal itself*. The native method of buying seed cocoons, getting the eggs, and rearing the worms, is full of mistaken notions and practices, and if an experimental silk farm under intelligent and practical management should be established in the centre of the cocoon producing districts of Bengal, by the aid of Government and the silk manufacturers. it is certain that good results may be obtained tending to improve the quality of these monthly species, by the distribution of the cocoons or eggs produced in the farm."

In connection with the subject of silk, the Secretary next read the following letter from Mr. Charles Brownlow of Cachar, and stated that he had received the cocoons therein referred to, and that they had been divided between Captain Hutton of Mussoorie, the Acclimatization Societies of Melbourne and Sydney, the Austrian, Italian and French Consulates :—

"I beg to advise you of my being about to despatch to your address a box containing 71 Atlas cocoons (live), which I trust you will cause to be distributed to parties likely to make experiments in rearing the silk. You will be the best judge of who will be likely to turn them to account, but I would suggest batches being sent to the Australian, Austrian and Italian Governments, Captain Hutton, M. Guerin De Meneville, &c.

"I shall shortly send for the Agricultural and Horticultural Society's report an account of the rearing of the brood in open air, in which process from first to last I met with no misadventure; the worm is evidently very docile and tractable.

"A batch of ten cocoons would be enough for experiment, and would yield at least two or three females, which at the rate of 400 eggs each, and allowing casualties, would consume the foliage of a couple of large trees, if not more.

Blighted Paddy.

Read the following letter from the Commissioner of the Presidency Division regarding the blighted condition of the Paddy crop in the vicinity of Diamond Harbour :—

"1. The accompanying *dhan* has been made over to me as a specimen of a very serious blight which has affected a considerable portion of the standing rice crop to the south of Diamond Harbour.

"2. I should be very much obliged if you would be so good as to favor me with any remarks which the knowledge and experience of yourself, or any member of your Society, can suggest as to the nature and cause of the blight.

"3. It is so far, as I understand, the result of the last heavy rains, which led to a considerable rice tract being submerged for a short time."

The Secretary said he had been favored by Mr. Wood-Mason, the Officiating Curator of the Indian Museum, with the following report on this blighted paddy :—

"The specimen of paddy just received is infested by a species of Ustilago smut in common parlance. Many species are known of this genus of parasitic fungi, which are determined partly from characters furnished by the spores; partly by the habit of the fungus, &c. They generally grow in the interior of the organs of plants, as in the case before me, in which the usual great deformity of the grains, absorption of the tissues, and their total replacement by aggregations of the spores of the fungus, have taken place. The interior of some of the grains presented a whitish gummy, interlaced, ill-definable thread like mycelium, which doubtless grows, in the manner described by Fulasne, at the expense of the surrounding tissues and sap of the infected organs, and at last becomes converted into a more or less coherent mass of spores ; these are of a dirty green colour on the exterior of the deformed grains; beneath the outer coating the aggregated spores are bright orange red; the central portion has a vesicular appearance and is white in colour.

"Now for a few words about the causes of this blight. Amongst these may be placed 'seasonal influence unfavourable to the healthy development of the paddy plant,' careless cultivation or absence of proper precautions in the choice of the seed. According to certain observations made some years ago, it seems probable that there are very few corn grains of any kind upon which it is impossible to discover several sporules of a fungus; a bad season comes in which, to take the present case, the plants are too long or too deeply covered by water, they get into an unhealthy condition, and the hitherto dormant germs start into life. This is as probable an explanation as I am able to offer. In animals certainly a lowered physique produces greater susceptibility of disease; this same more than probably holds good with regard to the vegetable world. In further corroboration of my explanation, I may mention the sudden occurrence of forms of animal parasitism to *sick* people."

The Secretary further read a note from Mr. J. D. Gash, of Pertapghur, Oudh, in continuation of that submitted at the last Meeting. Mr. Gash writes that he is unable to send, as requested, any perfect specimens of the bugs which have been committing such havoc on his Carolina paddy, as no traces of them are left, all having disappeared after he had applied neem oil-cake. "The crop"—adds Mr. Gash"—"seemed to rally after these pests left, and I have been collecting some paddy at different times, so that after all I expect some sort of a return. I will send you an account of the mode I pursued after I have collected the second crop which I am now watering."

Insects noxious to the Tea Plant.

The Secretary, lastly, called attention to a communication from Mr. E. L. Edgar of the Cossipore Tea Estate, Cachar (introduced in the Proceedings of November

1869), respecting certain insects which were then doing much harm to his plants. Dr. John Anderson, Curator of the Indian Museum, had examined these insects, but having no available means for determining them, he (the Secretary) had forwarded a second supply to Mr. Grote, who had referred them to Mr. F. Moore of the Indian Museum (London), and the following is the report on them, received through Mr. Grote, by the last mail:—

"I have to thank you for your note of the 21st with its enclosed insects which infest the tea plants in Cachar. The pretty bug, I find, is a variety of the *Pœcilocoris Hardwickii*, which insect, I believe, had been observed by Pemberton as infesting the tea plants of Assam many years back. The small beetle is a very common and well-known species of 'Phytophaga' belonging to the family *Cryptocephalidæ*, having been named by Fabricius as *Physanchenia pallens*. I should be glad if you will kindly intimate to the Secretary of the Agricultural and Horticultural Society of Calcutta that I should be very glad to have specimens of noxious insects for examination that may from time to time come to them, and would be much obliged for a copy of all MS. or published papers that the Society may have giving information on such subjects."

For the above communications and contributions the best thanks for the Society were accorded.

A. H. BLECHYNDEN,
Secretary.

REPORT

OF THE

Agricultural & Horticultural Society

OF INDIA.

Report from the Council to the Society at the General Meeting of the 23rd January 1871.

The commencement of another year renders it incumbent on the Council to submit a brief retrospect of the proceedings of 1870.

The number of members elected during 1870 is one hundred and forty. This is above the usual average, in fact greater than in any previous year since the formation of the Society, except that of 1865, when a hundred and sixty-three new names were enrolled. It is gratifying to note the comparatively large accession of members from the native community; the more so as of late years it was feared that they took but little interest in the proceedings of the Society. Sixteen new names have been added, which is greater than in any previous year since 1858, when the number registered nineteen. The loss by deaths and resignations is much the same as in former years. The following tabular statement shows the different classes of which the Society is composed.

Classification.	In 40 previous years.	In 1861.	In 1862.	In 1863.	In 1864.	In 1865.	In 1866.	In 1867.	In 1868.	In 1869.	In 1870.	Gross Total.	Total real number at the close of 1870 after deducting lapses.
Honorary Members	18	0	0	0	0	0	0	0	2	0	0	20	9
Associate Members	4	0	0	0	0	0	1	0	0	0	1	6	3
Corresponding Members ...	5	1	0	0	2	0	0	1	1	1	3	14	10
Civilians	500	22	13	12	18	30	18	16	17	22	25	693	192
Merchants and Traders ...	430	17	19	24	17	22	11	21	13	8	24	606	134
Indigo and other tropical agriculturists...	360	15	21	20	20	41	28	24	16	17	34	596	168
Military Officers	444	26	25	10	21	31	9	19	20	14	20	639	123
Medical Officers	169	6	7	5	7	14	5	7	6	6	5	229	55
Asiatics	183	8	3	7	9	8	9	7	8	9	16	267	67
Clergy	27	0	0	2	0	3	3	1	0	3	0	39	11
Law Officers	81	2	4	2	3	4	8	4	4	3	6	121	39
Miscellaneous	50	0	12	9	3	10	6	16	4	11	6	137	59
	2,263	97	104	91	100	163	108	116	91	94	140	3,367	870

N.B.—Of these 870 Members, 177 are resident in Calcutta, 549 in the country, and 144 in Europe.

The losses alluded to in the last column comprise twenty deaths,* sixty-three resignations, and sixteen removals from the list, their absence from India having exceeded four years, making in all ninety-nine.

Of the total number (870) in the foregoing list, thirty-four are Life Members, one hundred and eight are absent from India, twenty-two are Honorary, Associate and Corresponding, leaving seven hundred and six as the number of paying members on the books of the Society, or forty-eight more than last year. It is to be however feared that the names of at least fifty members will have to be struck off this list in the early part of 1871, in consequence of their arrears of subscription being heavy, with little probability of their paying up.

Among those members who have been lost to the Society by death, the Council would desire expressly to record the name of Dr. Thomas Anderson, late a Vice-President. A tribute of respect to the memory of this able and zealous officer was passed at the first meeting of the Society held after receipt of the melancholy intelligence of his death.

The Council have to congratulate members on the continued financial prosperity of the Society. Although the total amount of receipts for the past year appears to be Rupees 1,200 less than in the year 1869, it is nevertheless in excess of the average of previous years, and does not really contrast unfavourably with the past year, as extraneous items to the amount of Rupees 1,000 in the accounts for 1869 makes the principal difference.

The arrears, however, from Members, it is regretted to be recorded, is larger in 1870 than in 1869; but for which the accounts of the Society for the year under review would have been finally closed without showing, as it does now, a liability to its debit of Rupees 6,600. Owing to the prolonged war in Europe, the amount due to Messrs. Vilmorin, Andrieux and Co. could not of course be remitted, but all other accounts would have been finally closed.

The Council have to remark with regret the circumstances which have rendered necessary the adoption of the rule for the publication of names of ex-members and others, who, after availing themselves of the privileges of their membership, repudiate their liability to payment of subscription

* Rajah Sheanundun Sing, Dr. D. Begg, Baboo Saroda Persaud Mookerjee, Major J. W. Rind, Messrs. H. Walters, P. Auchidtzky, J. H. Adams, John Williams, R. B. Mackay, Major J. C. Middleton, Baboos Oomes Chunder Roy, Kishen Kishore Ghose, Col. A. A. McDonell, Rajah Prosono Narain Deb, Col. D. Gaussen, Col. Nedham, Major Geo. Weld, Captain H. W. Garnault, Dr. Thos. Anderson, and the Rajah of Kapurthulla.

and other dues for the year in which they had so exercised such privileges by virtue of their membership.

The Society has ever treated subscription and other sums due from its members as debts of honor, and if the consideration thus shown is to be abused, no other course is left but to publish the names of defaulters.

The arrangement which was made in 1869 with the Royal Botanical Garden has been continued during last year, whereby the Society has been able to meet, to a partial extent, the requirements of members for ornamental plants and fruit grafts. The number of applicants has been 210, to whom a total distribution of 2,564 fruit grafts and 9,794 ornamental plants has been accorded. The suggestion for propagation and culture of certain kinds of plants by means of cuttings has been very generally responded to, and the result has been tolerably successful in nearly every instance in which such cuttings have been despatched by pattern post. The total number of cuttings has amounted to twelve thousand.

The Council have not been idle during the year in respect to a new garden. Several localities have been visited, but there has been a want of success in obtaining a proper piece of ground. Since then, however, (December) the Council have addressed the Government for the piece of ground to the south of Belvidere, measuring about forty-one beegahs, and have offered to forego the annual grant of Rs. 5,000 now paid by Government to the Society, on condition of such ground being granted in perpetuity.

The annual importation of seeds from France, America and Australia has proved very successful, more especially as regards vegetable seeds. In consequence of the deplorable war still raging in Europe, the Council have been obliged to transfer the order from Messrs. Vilmorin, Andrieux and Co. of Paris, who have hitherto given satisfaction, to Messrs. Barr and Sugden of London. Both the English and American Seedsmen have been instructed to despatch their consignments *viâ* Suez Canal, as soon after receipt of orders as possible, in order that they may reach their destination in all April, and be distributed before the setting in of the rainy season.

A regular exhibition of vegetables and flowers was not held last year in consequence of the failure to obtain tents; but an interesting show of flowers was held in the Society's rooms in April, at which fair collections of rarer kinds of plants were submitted, consisting of orchids, bulbous plants, creepers and climbers, geraniums, ferns, verbenas, and some of the more popular annuals, such as Phlox, Portulacas, Petunias, &c.

But few rare plants have been exhibited at the Ordinary Monthly Meetings, and consequently but few marks have been assigned. The Silver Medal was awarded last year to Mr. A. H. Mowbray, for the successful introduction and cultivation of new and rare plants, particularly orchids; and to Mr. Samuel Jennings, in 1869, for his exertions for similar objects.

Among the subjects that have come before the Society, the propriety of again offering a prize for the best treatise on the cultivation of the Tea plant and manufacture of Tea has engaged attention. A premium of Rs. 500, and the gold Grant Medal has been offered for such a treatise, to be closed on 7th March next. Applications for copies of suggestions for the guidance of intending competitors have been numerous, and it is to be hoped the competition will be much greater than on the previous occasion in 1865.

Communications regarding several other important staple articles have also been received, such as Cotton, Silk, Tobacco, Cochineal. At nearly every monthly meeting during the year the question of Cotton has been discussed, and more recently some useful remarks by Dr. R. F. Thompson of Hooghly, respecting the utilization of Cotton *stalks*, have been submitted. Though the advantage of turning to useful account so large a portion of the plant has been recently descanted on by more than one writer in the pages of the Agricultural Journals of the United States, no action appears to have been taken in the matter. The specimen of fibre prepared under Dr. Thompson's superintendence has been ranked with very low quality jute; so that if it can be prepared at a sufficiently cheap figure, it might be found useful for some of the purposes to which inferior jute is put, and probably be added to the many paper-making materials which are now constantly brought to the notice of the trade. Dr. Thompson assumes that, in one district, that of Dharwar in the Bombay Presidency, where a large area of land is under cultivation, there is an annual loss of nearly 23 lakhs of Rupees at the very lowest calculation by throwing away the stalks of this useful plant.

In connection with this subject, it may be remarked that the utilization of Cotton seed has also been recently brought prominently to the notice of the English public. An oil from this seed has been for some years in the market, but it has not hitherto found much favor with consumers or the trade. From a paper read at the last meeting of the British Association, it would appear that about a million and-a-half tons of the seed are wasted annually. "The seed as it came from

the gin contained about fifty per cent of its weight of kernel, which yielded in the press about a third of its weight of oil, and two-thirds oil cake for cattle food; of the remaining fifty per cent, about a third consisted of the short cotton fibre adhering to the husk, and two-thirds of the husk itself. Mr. Rose estimated that American waste seed alone would yield annually about 250,000 tons of pure cotton, 250,000 tons of oil, and 250,000 tons of cattle cake. The husks with the adhering fibre could be treated so as to obtain the cotton quite pure for the manufacture of paper, to which purpose it is now being applied."

Sericulture has likewise been lately engaging more than the usual attention of the Society. Consequent on its present precarious state, a Special Committee was appointed in March last to consider the subject, and their report has been submitted to the Government of India. It is urged that "taking into consideration the disease which has devastated almost all the Silk-producing districts of Europe; the recent disastrous failure in the Persian province of Ghilan; the wars in China, whereby the mulberry plantations are stated to have been destroyed to an immense extent; that India should endeavour to increase her production and partially supply this great deficiency, which has of late pressed so heavily on the Silk trade of England." The Society has been in frequent communication with the Australian Colonies in sending them eggs of the different Silk-yielders of India, and with the Agricultural Society of the Cape of Good Hope, in furnishing information and reporting on samples raised in that Colony, though it is to be feared the result will not be successful. All attempts to raise the Japanese Silk Worm in the climate of Lower Bengal, though carefully tried by Mr. De-Cristoferis and others, have proved a total failure. The Society has been also in correspondence with the Silk Supply Association of London, which was established in 1869, and which appears to have now become an established institution, while the support rendered by the India Colonial and Foreign Offices has enabled it to collect much information, and through the medium of its journal to disseminate such information, and partially stimulate Silk cultivation in various parts of the world.

The distribution of good kinds of foreign Tobacco seed has caused some attention to be paid in India to this important but somewhat neglected staple. As respects Lower Bengal, the Society has received a report on the result of trialsowings of Virginia seed in the garden of the Maharajah of Burdwan. The produce has been reported to be equal to the best Brazil Tobacco. This favourable result will probably induce

the Maharajah to continue the experiments on an extensive scale in his large zemindaries in Burdwan, Midnapore and Cuttack.

Consequent on the great demand at present in Europe for Cochineal dye, attention is again attracted to the rearing of the South American species in this country. The Society has been in communication with the Mysore Government on this subject, in response to the enquiries of Colonel Boddam, of the Agricultural Department, in the Madras Presidency. More than 30 years have elapsed since the Society attempted, but unsucessfully, the introduction of the American species (*Grana-fina*) in Bengal. Ten years later, attention was turned to certain portions of the N. W. P. and the Punjab as affording a fair field for the improvement of the indigenous kind (*Grana sylvestra*) and for the introduction of the Mexican species, but no definite action was taken. The wild species which abounds in various parts of Bengal has been found, by ordinary culture, to yield a color equal in brightness to the domesticated Mexican species, but not to give more than one-third of the coloring matter.

The introduction of useful foreign grasses has occupied the attention of the Society for several years past. Repeated attempts had been made but unsuccessfully, to obtain seed of the Brazilian Grass (*Panicum spectabile*), a grass considered most appropriate for introduction into Upper India as it is reported to be independent of irrigation. Through the kind assistance of Dr. Hooker, C.B., Director, Royal Botanic Gardens, Kew, the Society obtained what was considered the true seed, and distributed it very extensively. It has taken kindly in various localities, but, unfortunately, it has proved to be Guinea Grass (*Panicum jumentorum*), a grass which was introduced by the Society nearly 40 years since, and is now pretty well spread throughout India ; but its value is lessened in the more arid part of the country from the circumstance that constant irrigation is necessary in the dry season for its preservation. Further attempts must again be made to obtain seed of the grass so urgently required.

The Society is indebted to its Corresponding Members, more especially to Captain Hutton, Lieutenant J. F. Pogson, and Mr. C. Brownlow, for many interesting communications. It has also received several notices, in continuation of those received the previous year, regarding insects noxious to certain plants, but have failed to obtain any reliable antidote to these pests. Further particulars regarding Carolina paddy have also been placed at its disposal. This superior description of paddy would seem to be gradually taking root in the Soonderbunds and other parts of Lower Bengal.

Only one number of the Journal has been published during the year (part I., vol. 2, new series), but it is an unusually bulky one, and includes, besides various interesting papers, a good deal of useful information regarding the yield of Rice, &c., in various districts in Bengal, Behar and Orissa, compiled from the answers received to a circular issued by the Society in 1866.

Statement of Receipts and Disbursements of the AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA, *from 1st January to 31st December* 1870.

RECEIPTS.

From Members—Subscriptions collected during the year	...	... ...	21,756 4 1
,, Government Annual Donation ...	...	... ...	5,000 0 0
,, accruings of Interest on Government Securities	...	... ...	1,343 15 4
,, proceeds of seed potatoes, seeds of forest trees and ornamental shrubs, silk worm eggs, country vegetable seeds medals, &c. &c	... ...	633 10 3	
,, proceeds of fruit grafts	... ...	1,678 2 4	
,, ,, of surplus stock of American, French and Melbourne vegetable and flower seeds	... ...	4,437 1 0	
,, proceeds of copies of publications of the Society	58 0 0		
And re-paid into Bank on account "Bishop's College Press"	85 8 0		
		143 8 0	
,, proceeds of Furniture re-sold ...	... ...	35 0 0	
,, Government—Rack-rent charged in 1869 refunded	... ...	34 0 0	
,, Members—Amount for glazed cases, pots, packing charges for seeds, &c. ...	4,198 3 2		
And for seed cabinets sold	100 0 0		
		4,298 3 2	
Amount re-paid for freight	.. ...	450 4 3	
,, in deposit for appropriation on various accounts	... ...	274 9 0	
			11,984 6 0
Total Receipts, Rupees ...	... ...	...	40,084 9 5
Balance in the Bank of Bengal on 31st December 1869	... ...	...	2,987 6 10
GRAND TOTAL, Rupees		...	43,072 0 3

DISBURSEMENTS.

PURCHASE OF SEEDS, &c.

By Messrs. James Carter & Co., for seeds supplied	258 0 0		
,, ,, D. Landreth & Sons, for ditto	4,254 13 7		
,, ,, Law, Somner & Co., for ditto	2,163 6 0		
		6,676 3 7	
,, sundry parties for country vegetable seeds, seeds of forest trees and ornamental shrubs, seed potatoes, Royal Botanical Garden for acclimatized flower seeds, silk worm eggs, medals, &c. &c.	564 10 10		
And for cost of fruit grafts, pots, wardian cases, boxes, &c., on account of members	430 7 8		
		995 2 6	
			7,671 6 1
Carried over ...			7,671 6 1

Brought forward ...		7,671 6 1

Library Account.

By sundry parties for books purchased	490 14 1	
" " " binding books	27 0 0	
		517 14 1

Printing Account.

By sundry parties printing letters of call, money receipts, &c. &c.		125 0 0

Journal Account.

By Bishop's College Press printing, &c., 700 copies of Journal, Vol. I., Part IV., and part of Vol. II., Part I	431 0 0	
" Messrs. T. Black & Co. printing and completing 700 copies of Journal, Vol. II., Part I.	558 12 0	
" City Press printing Proceedings of Meetings	116 1 0	
" sundry parties for preparing matters for Journal ...	81 14 0	
		1,187 11 0

Nursery Garden.

By Establishment, from December 1869 to November 1870	1,065 14 3	
" purchase of seedlings, pots, boxes, wardian cases, including dinghy-hire, &c.	1,058 14 6	
		2,124 12 9

Establishment Account.

From December 1869 to November 1870		11,461 15 2

Advertisement Account.

By advertising notices of meetings, seeds for distribution, &c.		173 0 0

Freight Account.

By freight paid on boxes of seeds, books, &c., from America, France, Melbourne and other places	166 12 9	
And on packages of seeds, &c., sent forward for members	495 5 0	
		662 1 9

Furniture Account.

By sundry parties for purchase of furniture, including camphor-wood planks for seed boxes		218 1 0

Grote Testimonial.

Paid Superintendent, School of Arts, balance of Account for engraving, illuminating and framing the address, including charges for shipping, landing, &c.		284 5 6

Metcalfe Hall.

By proportion of House, Police and Lighting Rates from October 1869 to 30th September 1870, and Water Rates to 31st December 1870	674 1 6	
" sundry petty repairs, &c.	44 8 6	
		718 10 0
Carried over ...		25,144 13 4

Brought forward ...		25,144 13 4
STATIONERY ACCOUNT.		
By sundry parties for Stationery		104 4 6
REFUND ACCOUNT.		
By sundry parties for balance of Account refunded		34 0 0
ACCLIMATIZED PEA ACCOUNT.		
By cost of imported Pea seed forwarded to F. Halsey, Esq., Umritsur, for raising a crop of Peas for 1871	30 0 0	
,, ditto ditto A. J. Sturmer, Esq , Talooka Kojha, for ditto ditto	10 0 0	
		40 0 0
FLORICULTURAL SHOW.		
By cost of Show held at the Metcalfe Hall in April 1870		30 4 3
LOAN ACCOUNT.		
By balance of loan of Rs. 50 to Seraj, the Bill collecting peon		26 0 0
TEA ESSAY.		
By printing particulars and advertising prize for the above		65 7 0
PETTY CHARGES.		
By Postages on letters, Journals, &c., sent and received ...	166 15 10	
,, Bank of Bengal cost of stamped Cheques and commission on interest drawn on Securities	9 8 1	
,, Punkah-wallahs, pensioner, hackery, coolie and boat-hire, extra writers, packermen, landing charges, cost of tin, wax cloth, sealing, tin men, carpenter, markers, gunny-men, &c.	902 3 7	
		1,078 11 6
INVESTMENT ACCOUNT.		
By sundry parties purchase of Government Securities for Rs. 14,000		14,786 0 8
Rupeess ...		41,309 9 3
Balance in the Bank of Bengal on 31st December 1870		1,762 7 0
GRAND TOTAL, Rupees ...		43,072 0 3

EMORANDUM

Disbursements.

To amount of Disbursements during the year 1870, as per Statement	26,523	8	7			
„ amount invested in the purchase of Government Securities for Rs. 14,000	14,786	0	8			
				41,309	9	3
„ balance in the Bank of Bengal on 31st December 1870				1,762	7	0
Total Rupees ...				43,072	0	3

Receipts.

By amount of Receipts during the year 1870, as per Statement	40,084	9	5
„ Balance in the Bank of Bengal on 31st December 1869	2,987	6	10
Total, Rupees ...	43,072	0	3

Liabilities.

Messrs. James Carter and Company for balance of seeds received in 1869	£173	15	2			
„ Law, Sonner and Company for balance of seeds received in 1870	£217	0	0			
„ Vilmorin, Andrieux and Company for seeds received in 1870	£260	0	0			
Total ...	£650	15	2			
Or Rupees ...				6,508	0	0

Dependencies.

Amount invested in Government Securities, lodged in the of Bengal...				42,833	5	3					
„ of Cash in the Bank of Bengal				1,762	7	0					
								44,595	12	3	
Balance of Subscription, &c., due from members, ex-members, who have not contributed nor participated in the privileges of the Society for the last three years and upwards				6,786	15	1					
„ of Subscription in arrear for the years 1868, 1869 and 1870	Rs. 2,847	6	3								
Outstanding for seeds, grafts, copies of Journals, &c. ...	Rs. 660	0	0								
				3,507	6	3					
								10,294	5	4	
Total, Rupees ...								54,890	1	7	

LIST OF MEMBERS

OF THE

Agricultural and Horticultural Society

OF

INDIA.

DECEMBER 31st, 1870.

ALPHABETICALLY ARRANGED

AND

DISTINGUISHING THE YEAR OF ADMISSION.

Office Bearers.

President:

J. A. CRAWFORD, ESQ.

Vice Presidents:

BABOO PEARY CHAND MITTRA.

DR. C. FABRE-TONNERRE.

W. STALKARTT, ESQ.

COL. E. A. C. WINTLE.

Secretary and Treasurer.

A. H. BLECHYNDEN, ESQ

Members of Council:

A. H. MOWBRAY, ESQ.

L. BERKELEY, ESQ.

S. H. ROBINSON, ESQ.

A. STIRLING, ESQ.

BABOO RAMANAUTH TAGORE.

RAJAH SUTTYANUND GHOSAL.

R. BLECHYNDEN, ESQ.

W. PIGOT, ESQ.

S. P. GRIFFITHS, ESQ.

M. HENDERSON, ESQ.

B. D. COLVIN, ESQ.

J. M. ROSS, ESQ.

Patron :

HIS EXCELLENCY THE RIGHT HON'BLE EARL OF MAYO.

List of Members.

* This mark denotes Members who have compounded for their Annual Subscriptions.

† This mark denotes Members who are absent from India, and therefore non-contributors.

‡ This mark denotes Members who, though absent, are desirous of continuing their Subscriptions.

HONORARY MEMBERS.

The Right Honorable Sir Edward Ryan, A. M., F. A. S., London	1828	1841
Colonel John Colvin, C. B., London		1830
J. Mackay, Esq.		
Don Ramon de la Sagra, Island of Cuba ...		
Dr. Justus Leibig, Professor of Chemistry in the University of Giessen		1843
The Right Honorable Sir Lawrence Peel, London	1842	1856
R. Fortune, Esq.		1856
A. Grote, Esq., London	1837	1868
The Revd. T. A. C. Firminger, London ...	1851	1868

CORRESPONDING MEMBERS.

D. J. Macgowan, Esq., M. D., Ningpo ...	1851
Mons. Natalis Rondot, Paris	1858
Capt. Thos. Hutton, F. G. S., Mussoorie ...	1861
Lieut.-Col. W. H. Lowther, Jubbulpore ...	1864
James Cowell, Esq., London	1864
Dr. H. Cleghorn, Edinburgh	1867
Vause Fretwell, Esq., Supdt. of Model Farms at Bhurgaums, Kandeish	1869
C. Brownlow, Esq., Cachar	1870
Lieut. J. F. Pogson, Simla	1870
Dr. Geo. King, Dehra Dhoon	1870

ASSOCIATE MEMBERS.

Capt. E. P. Nisbet, London	1842
John Scott, Esq., Curator, Royal Botanic Garden, Calcutta	1866
Geo. Bartlett, Esq., Calcutta	1870

ORDINARY MEMBERS.

A.

		Admitted.
ABBOTT, Horace, Esq., Rajahpore via Koosteah	...	1858
Abbott,† Lieut.-Col., J. R.	... ...	1865
Abdool Gunny, Kajee, Zemindar, Dacca	... ...	1860
Achard,† Lewis Frederick, Esq., Merchant	... ...	1862
Adams, G. Esq., Civil Service, Kirwee via Manickpore	...	1870
Ady, Charles, Esq., Merchant, Moulmein	... ...	1864
Agabeg, Malchus, Esq., Advocate, Rangoon	...	1866
Ainslie, W. Esq., Civil Service, Calcutta	... ...	1847
Aitchison, W. Esq., Manager, Doloo Tea Garden, Cachar		1869
Alexander, N. Stuart, Esq., C. S., Malda	...	1864
Alexander, W. Esq., Merchant, Calcutta	...	1865
Alexander, † Lieut.-Col. W. R. E.	... ...	1867
Alexander, Lieut. G., Assistant Commissioner, Thayet Myo, Burmah	... ...	1870
Allen, Thomas Tayler, Esq., C. S., Beerbhoom	...	1866
Allen, Dr. Bedford, Civil Surgeon, Patna	...	1869
Ameer Allee Khan, Moonshie, Bahadoor, Calcutta	...	1869
Anderson, Lieut.-Col. W. W., Political Agent, Kattywar		1859
Anley, George, Esq., Civil Engineer, Purneah	...	1861
Anthony, Adam, Esq., 1st Assistant Accountant-General, Allahabad	... ...	1870
Archer, Revd. J. B., Parsonage, Kurseong	...	1869
Armstrong, C. M., Esq., Opium Dept., Bareilly	...	1858
Armstrong, T. W., Esq., Supdg. Engineer, Takly, Nagpore, Central Provinces	... ...	1862
Armstrong,† J. S., Esq., C. S.	... ...	1865
Ashburner, Lieut.-Col., John, (Bombay Staff Corps) Deputy Commissioner, Seroncheе, Upper Godavery, C. P.		1864
Assistant Forest Conservator, Mussoorie	... ...	1870
Atkinson, W. S. Esq., Director, Public Instruction, Calcutta	... ...	1864
Austen,† Capt. Godwin, Survey Dept.	... ...	1867

B.

BADGER,† A. Esq., Manager, Equitable Coal Company's Colliery	... .	1867
Bainbridge, Reginald, Esq., Tea Planter, Gowhatti	...	1866
Bainbridge, A. R. Esq., Civil Service, Midnapore	..	1868
Baird, Lieut.-Col. A. F., Executive Engineer, Allahabad	...	1861
Balfour,† H. Esq., C. S.	... ...	1865
Banister,† Dr. G.; F. R. C. S., Governor General's Body Guard	... ...	1868

	Admitted.
Banerjee, W. C. Esq., Barrister-at-Law, Calcutta ...	1869
Barlow, G. N. Esq., Civil Service, Monghyr ...	1864
Barnes,† H. B. Esq., Superintending Engineer, P. and O. Co.'s Service	1866
Barnes, C. H. Esq., Julpigoree	1868
Barrow,† F. Esq., Solicitor	1866
Barstow,† H. C. Esq., Civil Service	1868
Bartlett, Lieut.-Col. H. T., Bengal Staff Corps, Saugor ...	1865
Bailey, Lieut. Frederick, Royal Engineers, Chukrata ...	1870
Bayley, E. C. Esq., Civil Service, Calcutta ...	1863
Bayley, Stuart Colvin, Esq., Civil Service, Tirhoot ...	1859
Barker, Dr. R. A., Civil Surgeon, Serampore ...	1870
Beadon,† Sir C.	1855
Beadon, Henry Esq., Civil Service, Calcutta ...	1867
Beaufort, Francis L., Esq., Civil Service, Calcutta ...	1838
Becher, William, Esq., Gowhatti	1855
Becher, J. M. Esq , Indigo Planter, Purneah... ...	1862
Beeby, G. O. Esq., Solicitor, Calcutta	1866
Belli,† C. H., Esq.	1863
Benson,† Col. J. C.	1863
Benson, George, Esq., Pleader, High Court, N. W. P., Bareilly	1868
Bentall,*† Edward, Esq., Civil Service	1837
Berkeley, L. Esq., Commr., Paper Currency, Calcutta ...	1855
Berkeley, Vilters, Esq., Judge, Small Cause Court, Agra	1869
Bertelson, H. H. F. Esq., Tea Planter, Mohurgong, Darjeeling	1868
Betts, C. G. D. Esq., Ourungabad via Pakour ...	1867
Beveridge, H. Esq., C. S., Backergunge ...	1865
Beaumont, Dr. Thomas, Residency Surgeon, Indore ...	1870
Becher, Colonel S. Commanding Troops, Delhi ...	1870
Beer Chunder Manick, Bahadoor, Maharajah of Tipperah	1870
Bejoy Kesub Roy, Bahadoor Rajah of Andool ...	1870
Bhopal, H. H. the Begum of	1870
Bhowany Sing,* Maharajah, Duttea	1864
Bickham,† Geo. Esq., Merchant	1869
Bignell, R. A. D'O. Esq., Assistant Superintendent of Police, Jessore	1867
Bimala Churn, Bhuttacharjea, Deputy Collector and Magistrate, Nowada	1870
Bindabun Chunder Mittra, Baboo, Calcutta	1853
Birch, Capt. R. G., Cawnpore	1867
Birch, Lieut. H. H., 27th P. N. I., Bareilly	1869
Bishop,*† Major H. P. (Artillery)	1853
Blacker, G. M., Esq., Merchant, Calcutta	1856
Blechynden, R. Esq., Merchant, Calcutta ...	1858

B.—(*Continued.*)

Admitted.

Blechynden, A. H. Esq., Secretary Agri.-Hort. Society of India, Calcutta 1851
Bond, F. Esq., Executive Engineer, Cuttack ... 1867
Booth, Dr. B. S. Mozufferpore, Tirhoot 1867
Bouchier, Brigadier General G. C. B., Royal Artillery, Shillong 1868
Boulderson,† A. Esq., Civil Service 1865
Bourne,† Walter, Esq., Resident Engineer, E. I. Railway 1855
Bowser, H. C. Esq., Civil Surgeon, Rungpore ... 1865
Brae, T. Esq., Dobracole, Commercolly viâ Koosteah ... 1854
Brandis, Dr. D. Supdt. of Forests 1857
Brander, James, Esq., E. B. Railway, Sealdah ... 1865
Bridgman, J. H. Esq., Gorruckpore 1868
Brock, Charles Esq., Merchant, Calcutta ... 1867
Brodhurst, M. Esq., Civil Service, Benares ... 1859
Brodie,*† Major T. 1836
Broome, Major-General Arthur, Royal Artillery, Calcutta 1864
Broucke, W. J. Esq., Indigo Planter, Loureah Factory, Betteah 1859
Brougham, Dr. J. P., Presidency Surgeon, Calcutta ... 1867
Broughton,† Captain W. E. Delves, 44th N. I. ... 1866
Broughton,‡ E. Esq., Merchant 1865
Brown, Dr. Robt., Political Agent, Munneepore ... 1868
Brown, Walter, H. Esq., Merchant, Calcutta ... 1869
Browne, Lord Ulick, Civil Service, Chittagong ... 1867
Browne,† Revd. J. Cave 1866
Brown, Forbes Scott, Esq., Merchant, Penang .. 1840
Brown, Lieut.-Col. D., 1st Madras Fusiliers, Moulmein ... 1856
Brown, J. A. Esq, Superintendent of Roads, Cachar ... 1870
Browning, Fred. R. Esq., Civil Engineer, E. I. R. Chord Line, Seetakotta via Setarampore 1867
Brundell,† R. S. Esq., Resident Engineer, E. I. Railway... 1862
Buchanan,† George Esq, Merchant 1862
Buckingham, J. Esq., Tea Planter, Duflating, Golaghat... 1867
Buller,*† Frederic Pole, Esq., Civil Service ... 1837
Bury, Percival, Esq., Tea Planter, Cachar ... 1869
Buskin, F. G. Esq., Calcutta 1864
Buskin, M. Esq., Serepore Factory, Chuprah ... 1870
Butt, Geo. Esq., Civil Service, Shajehanpore ... 1866
Bull, William, Esq., Resident Engineer, Oudh Railway Company, Lucknow 1870
Buck, E. Esq., C. S., Furrackabad 1870
Byrne, Walter A. Esq., Opium Department, Ghazeepore 1870

C.

	Admitted.
CAMERON,† Dr. J. McLeod, Civil Surgeon ...	1865
Cameron, J. T. D. Esq., Calcutta	1869
Campbell, W. F. Esq., Comillah	1838
Campbell,*† Archibald, Esq., M. D.	1838
Campbell,† Hon'ble Geo., Civil Service	1865
Carew,* R. R. Esq, ...	1846
Carleton, C. F. Esq., Indigo Planter, Belwah, Chumparun	1868
Carnac,† C. F. Esq., Civil Service	1865
Carnac, H. Rivett, Esq., Cotton Commissioner, Central Provinces and the Berars, Nagpore	1869
Carrick, Henry Esq., Locomotive Supdt, E. I. Railway, Jamalpore	1863
Castle, C. T., Supdt. of Police, Banda	1865
Carter, J. H. Esq., Civil Service, Bustee	1870
Carter, T. E. Esq., Merchant, Calcutta	1870
Campbell, D. W. Esq., Locomotive Supdt. E. I. Railway, Jamalpore	1870
Chambers, Charles, Esq., Civil Engineer, E. I. Railway, Jamalpore	1868
Chapman, † R. Esq., Merchant	1867
Chardon, W. B. Esq., Seepah Factory, Zillah Gya ...	1864
Chauntrell, F. D. Esq., Solicitor, Calcutta	1870
Cheke, J. M. G. Esq., Bancoorah	1860
Chennell, Thos. Esq., Chundyghat Estate, Cachar ...	1870
Chester,† Capt. H. D. E. W. Offg. S. A. C. G. ...	1869
Chrestien, T. Esq, Banally, Raneegunge	1864
Christian, A. Esq., Indigo Planter, Oomgong Factory, Mudhoobanee, Tirhoot	1869
Christian, A. Esq., Puttirghat Factory, Mudheypoora, Bhaugulpore	1870
Cheetham, W. H. Esq., Merchant, Calcutta	1870
Chunder Kaunt Mookerjee, Baboo, Calcutta... ...	1866
Clark, Dr. Stewart, Inspector-Genl. of Prisons, N. W. P., Allahabad	1855
Clarke, † Capt. Harvey M. Stanley, Supdt. of Police ...	1865
Clarke, R. J. Esq., Executive Engineer, Allahabad ...	1867
Clarke, H. P. Esq., Manager, Borokai Garden, Cachar ...	1870
Clay, A. L. Esq., Dept. Commr, Maunbhoom ...	1868
Cockburn, W. Esq., Indigo Planter, Doomra, Tirhoot ...	1861
Cockburn, J. F. Esq., Kanoo Junction, Burdwan ...	1866
Cockerell, Horace Esq., Civil Service, Burdwan ...	1861
Cogswell, W. H. Esq., Calcutta	1866
Cole, Revd. J. Supdt. Lawrence Asylum, Sanawur ...	1865
Collector of Mynpooree	1867

		Admitted.
Collis, S. E. Esq., Solicitor, Calcutta	... ...	1859
Colvile, *† Sir J. W.	... ...	1849
Colvin, B. D. Esq., Merchant, Calcutta	... ...	1868
Cooke, F. C. Esq., Bhaugulpore viâ Azimghur and Toortiepore	... ...	1866
Cope,† Henry, Esq., Merchant	... ...	1847
Corbyn, the Revd. H., Abbottabad, Hâzara, Punjab	...	1865
Cornell,† W. Esq., Civil Service	... ...	1861
Cosserat, Lewis Esq., Indigo Planter, Burhogah viâ Sewan		1859
Cosserat, A. W. Esq , Depy. Magte., Berhampore	...	1865
Courjon, Alfred, Esq., Zemindar, Chandernagore	...	1863
Courjon, Achille Esq., Chandernagore	... ...	1869
Cowley, F. W. R. Esq., Civil Service, Chittagong	...	1867
Coxhead, T. Esq., Joint Magistrate, Sewan, Sarun	...	1868
Conti, Geo. Esq., Calcutta	... ...	1870
Connell, T. Esq., Sildoobie Garden, Cachar ...	..	1870
Comber, B. E. C. Esq., Tea Planter, Debrooghur	...	1870
Craddock, Dr. W., 1st Goork, Regt., Dhurumsalla	...	1868
Craster, † E. C. Esq., Civil Service	... ...	1858
Crawford, J. A. Esq., Civil Service, Calcutta, (President)		1857
Crommelin, C. R. Esq., Pertabghur, Oude ...	...	1860
Crommelin, Lieut.-Col. J. A., Darjeeling	... ...	1857
Crooke,† Henry Esq., Merchant	... ...	1858
Crosthwaite, R. J. Esq., B. A., C. S., Budaon	...	1869
Cresswell, S. Esq., Calcutta	... ...	1870
Cumberlege, Major-Genl. E. A., Mussooree ...	...	1866
Cumming, W. Esq., Indigo Planter, Rajmehal	...	1851
Cummins, J. G. Esq., Telegraph Master, Cachar	...	1870
Currie, Charles Esq., Civil Service, Jaunpore	...	1855
Currie,† Capt. H. O., 19th Hussars	... ...	1865
Currie, G. M. Esq., Civil Service, Cuttack ..	...	1868
Curtis, J. F. Esq., Indigo Planter, Ramcollah, Chuprah ...		1860

D.

DACOSTA, Joseph, Esq., Pleader, Civil Court, Bhaugulpore		1865
Dalton, Lieut.-Colonel E. T., Commissioner of Chota Nagpore	... ...	1848
Daly, F. D. Esq., Manager, Simla Bank, Umballa	...	1867
Daly, R. M. Esq., H. M., Bengal Marine, Calcutta	...	1869
Dashwood, H. W. Esq., Civil Service, Agra	...	1860
Daunt, W. Esq., Shapore, Oondie, Tirhoot	...	1857
Davies,‡ I. Lieut.-Col. J. S.	... ...	1857
Davies,† Lieut.-Col. F. J.	... ...	1869
Davis, W. P, Esq., Bengal Police, Midnapore	...	1870

D.—(Continued.)

	Admitted.
Davidson, James, Esq., Cachar	1870
Dalton, G. B. T., Esq., Civil Service, Monghyr ...	1870
Dear, Herschel Esq., Monghyr	1860
Debendra Nath Mullick, Baboo, Calcutta ...	1870
Degumber Mittra, Baboo, Calcutta	1866
Delane,† Major G.	1864
Delane, Major W., R. H. A., Mean Meer ...	1868
Delauncy, J. P. Esq., Indigo Planter, Commillah ...	1862
Deputy Commissioner of Sumbulpore	1866
Deputy Commissioner of Oomraotee	1869
Deputy Commissioner of Ellichpore	1869
Deputy Commissioner of Woon	1869
DeSaran, Eugene Dubois, Esq , Culna	1858
Dessa, H. J. Esq., East India Railway, Arrah ...	1870
Deveria, J. Esq , Zemindary Manager, Bengal Coal Company, Raneegunge	1866
Deverell, H. Esq., Indigo Planter, Ackrigunge Factory viâ Berhampore	1854
Dias, T. C. Esq., Advocate, Moalmein	1866
Dickens,† Lieut.-Col. C. H., Artillery	1856
Dickson,† G. Esq., Secy. and Treasurer, Bank of Bengal...	1863
Dodgson, W. Esq., Kallygunge Factory, Rungpore ...	1864
Dombal, M. E. Durup de, Esq., Jaffergunge via Furreedpore	1860
Dowson, George E. L. Esq., Advocate and Notary, Moulmein	1867
Doyne,† Richard, Esq., Barrister-at-law	1855
Drummond,† E. Esq., Civil Service	1866
Drury, Col. C. C., Police Department, Lucknow ...	1860
Ducas, C. Esq., Civil Engineer, Burrakur ...	1867
Duff, W. P. Esq., Merchant, Calcutta	1867
Duffin, Col. R., H. M. Bengal Army, Umballa ..	1868
Dunne, A. D. Esq , Indigo Planter, Suburncolly viâ Serajgunge	1862
Duckina Runjun Mookerjee, Roy Bahadoor, Talookdar in Bengal and Oude, Lucknow	1870

E.

Eames, R. Esq., Merchant, Debrooghur	1855
Earle, Dr. F. J., Civil Surgeon, Kishnaghur ...	1859
Eddis, W. U. Esq., Sericole, Nohatta via Magoorah ..	1858
Eddy, H. C. Esq., Dacca	1865
Eden, Hon'ble A., Civil Service, Calcutta ...	1870
Edgar, J. W. Esq., Civil Service, Cachar ...	1869

E.—(Continued.)

Admitted.

Edgecombe,† E. J. Esq.	1868
Edwards, Anthony, Esq., Mootteeharree, Chumparun ...	1866
Egerton, R. E. Esq., C. S., Punjab	1864
Eisenlohr, F. Esq., Merchant, Calcutta ...	1870
Eldridge, F. G. Esq., Merchant, Calcutta ...	1867
Eliot, Col. John, Artillery, Morar	1839
Elton,† Dr. H. N.	1865
Erskine, H. C. Esq, Indigo Planter, Elambazar, Soorool	1855
Ewing,† R. L. Esq., Indigo Planter	1863

F.

FAGAN, G. S. Esq., Barrister, Supreme Court, Calcutta ...	1855
Fairley, W. C. Esq., Merchant, Bassein, Pegu ...	1866
Falcon, A. B. Esq., Civil Service, Rungpore ...	1858
Farquharson, D. Esq., Mungulpore, Raneegunge ...	1866
Farquhar, Capt. J. H. T. Stud Dept., Poosa ...	1869
Fawcus, Dr. J., Supdt. of Jail, Alipore	1870
Fenwick, Capt. G. R., Calcutta	1865
Fergusson, Hugh, D. Esq., Indigo Planter, Allyghur ...	1867
Ferris, Dr. G. R., Calcutta	1865
Fisher, Lieut.-Col., G. B., District Supdt. of Police, Barrackpore	1865
Fitzgerald, Capt. O. Tea Planter, Byjnauth, Kangra ...	1866
Fitzpatrick, Dr. A., Calcutta	1866
Forbes, Major H. T., Kishnaghur	1856
Forbes, A. Esq., Civil Service, Behar viâ Bucktearpore ...	1869
Forbes, Lieut. James, Dum-Dum	1869
Forbes, J. C. M. Esq., C. E., Assistant Engineer, Raj-Durbangah	1870
Forlong, Lieut.-Col. J. G. R., Rajpootana	1870
Franklin, Capt. W., H. M.'s 76th Foot, Tonghoo ...	1870
Fraser, W. T. Esq., Bank of Bengal, Patna	1867
Fraser, G. Esq., Indigo Planter, Gopalpore Factory, Jaunpore	1870
Fraser, Major the Hon'ble W. M. Hummeerpore ...	1870
Freeman, H. Esq., Lall Serriah Factory, Seegowly, Chumparun	1866
French, Henry, G. Esq., Calcutta	1839
French, E. L. Esq., Tea Planter, Numalighur viâ Komargawn, Upper Assam	1864
Fukeeroodeen, Prince Mahomed, Hooghly... ...	1868
Fytche, Major General A., Chief Commr., British Burmah, Rangoon	1849

G.

Admitted.

GAIR, Alexander Esq., Merchant, Rangoon ... 1867
Galiffe, J. F. Esq., Collector of Canal Tolls, Calcutta ... 1856
Garbett, Lieut. C. H. Assist. Commr., Maunbhoom ... 1868
Gash, J. D. Esq., Indigo Planter, Jugdesgurh Factory, Beylah, Pertabgurh, Oude 1867
Gibbon, T. M. Esq., Indigo Planter, Betteah Factory, Tirhoot 1860
Gibbon, W. F. Esq., Senr., Doolha Factory, Goruckpore... 1870
Gillanders, W. F. Esq., Solicitor, Calcutta ... 1868
Gillam, F. A. Esq., Agent, Bank of Bengal, Mirzapore ... 1870
Glass, J. Esq., Asst. Engineer, Enchempelly, Upper Godavery via Seroncha 1866
Gleig,† Capt. McDougall, Bombay Invalid Establishment 1868
Goad,† G. S. Esq., Manager, Assam Company's Dhubba Division 1866
Goode,† Lieut.-Col., Madras Army 1865
Goodeve, Lewis, Arthur, Esq., Barrister, Calcutta ... 1868
Gordon, D. T. Esq., Manager, Silk Filatures, Surdah ... 1859
Gordon, John Esq., Bank of Bengal, Calcutta ... 1865
Gouldhawke, J. Esq., Caragola 1851
Gowan, Major J. Y., Bengal Staff Corps, 2nd in Command, 33rd Regt. N. I., Allahabad 1865
Grace, Geo. Esq., Sylcooree, Cachar 1865
Graf, C. Esq., Merchant, Calcutta 1869
Graham, Joseph Esq., Barrister-at-Law, Calcutta ... 1858
Graham, W. F. Esq., Indigo Planter, Colgong ... 1862
Graham,† A. Esq., Merchant 1868
Graham, Charles, Esq., Castleton, Kurseong ... 1869
Grant, Thomas Esq., Indigo Planter, Bhagulpore ... 1848
Grant, G. H. Esq., Indigo Planter, Bhagulpore ... 1859
Grant, John Peter Esq., Junr., Civil Service, Bancoorah... 1860
Grant,† T. R. Esq., Merchant 1863
Grant, C. Esq., Darjeeling 1864
Gray, J. J. Esq., Indigo Planter, Dacca 1846
Gray, Henry, A. Esq., Solicitor, Calcutta 1869
Gray, Dr. Edward, Medical Officer, Jorehaut Tea Company, Cinnemara, Assam 1868
Green, Randle E. Esq., Merchant, Calcutta 1866
Greenhill, T. Esq., V. S. Calcutta 1865
Gregory, J. A. Esq., Calcutta 1870
Gress Chunder Sing, Coomar, Zemindar, Pikeparrah near Calcutta 1867
Grey, The Hon'ble W., Lieutenant-Governor of Bengal, Calcutta 1867
Grey, E. Esq., Berhampore 1869

G.—(Continued.)

		Admitted.
Griffiths, S. P., Esq., Merchant, Calcutta	..	1844
Griffith, Ralph Esq., Principal, Queen's College, Benares		1870
Grote, A. G. Esq., Baraitch, Oude ...	...	1866
Growse, F. S. Esq., Muttra ...	...	1870
Grylls,† Dr. W. R., Civil Surgeon ...	...	1867
Guise, J. J. Esq., Merchant, Calcutta ..	...	1867

H.

Hadow, Dr. G. R. Moradabad ...	...	1865
Haldane, V. H. Esq., ...	...	1867
Halsey, F. Esq., Manager, Branch Bank of Bengal, Umritsur	...	1863
Halkett, D. C. Esq. Civil Service, Mozuffernuggur	...	1870
Hall, R. W. Esq., Balladhun Garden, Cachar	..	1870
Haly, Major General W. O., G. C. B., Peshawur	...	1862
Hamilton,† Major, T. C., Inspector General of Police	...	1862
Hamilton, J. C. Esq., Indigo Planter, Hattie, Oostee, Tirhoot	...	1867
Hamilton, T. F. Esq., Merchant, Calcutta	...	1870
Hampton, C. J. Esq., Civil Engineer, Rampore Haut	...	1862
Hankin,† Major G. C.	...	1864
Harris,† G. L. Esq., C. S.	...	1863
Harrison, H. A. Esq., Civil Service, Humeerpore	...	1863
Harrold, H. M. Esq, Tea Planter, Punkabaree, Darjeeling	...	1863
Hastings, Dr. Thos., Deputy Inspector General of Hospitals, Meean Meer	...	1868
Haughton, Col. J. C. Commr., Cooch Behar, Julpigoree	...	1859
Haworth, J. H. Esq., Broker, Calcutta	...	1870
Hawkins,*† John Abraham Francis, Esq.	...	1837
Hay, T. J. Esq., Manager, Sildoobie Tea Garden, Cachar		1870
Hayes, Dr. W. H., Chyebassa, Singbhoom ...	...	1861
Hazlett, Dr. H. L., Madras Army, Enchempelly	...	1869
Health Officer, Calcutta	...	1865
Heely, W. L. Esq., C. S.. Rampore Beauleah	...	1864
Henderson, Dr. G., Civil Surgeon, Lahore, Punjab	...	1863
Henderson, M. Esq., Merchant, Calcutta	...	1864
Heralall Seal,* Baboo, Calcutta ...	...	1858
Herklots. D. G. Esq., Agriculturist Calcutta...	...	1870
Herbert,† Col. C.	...	1864
Herschell, W. J. Esq., Civil Service, Kishnaghur	...	1870
Heseltine, R. H. Esq., Rajpore ...	...	1869
Hewitt,† J. F. K. Esq., Civil Service ...	...	1860
Higgs,† Revd. E.	...	1853

	Admitted.
Hildebrand,† Major C. P.	1864
Hill, Dr. J. H. G. Barrah. Tirhoot	1865
Hill, R. H. Esq., Seraba, Tirhoot	1865
Hills,† Archd. Esq., Indigo Planter	1863
Hills,*† James, Esq., Senior, Indigo Planter ...	1837
Hinde, W. H. Esq., Merchant, Calcutta	1869
Hindhaugh T. S. Esq., Chowkeedangah, Raneegunge ...	1870
Hindmarsh, Thomas, Esq., Eastern Bengal Railway, Kanchrapatah	1866
Hittoll Messer, Baboo, Zemindar, Mauncoor	1864
Hobart, R. T. Esq., Etah	1870
Hobday, Alfred Esq., Merchant, Moulmein	1866
Hogg, Capt. T. W. Assistant Commissioner, Hoshungabad	1868
Hollway, F. H. Esq., Indigo Planter, Monghyr ...	1863
Holloway, Capt., 5th Irregular N. I., Nagode ...	1870
Holroyd, Col. Charles, Debrooghur, Assam ...	1866
Homfray, J. N. Esq., Bengal Marine Service, Port Blair...	1863
Hoskins, Dr. Civil Surgeon, Ranchee ...	1870
Howard,† A. C. Esq. ...	1863
Howard, Bernard, Esq., Merchant, Mirzapore ...	1868
Howard, Dr. J. S. Civil Surgeon, Oomraotee ...	1870
Howe, W. A. Esq., Bulleah, Ghazeepore ...	1870
Hudson,† Cunningham, Esq , Merchant ...	1867
Hudson, C. E. Esq., Talooka, Pinjra, Azimghur ...	1870
Hutchinson,† Dr. R. F.	1860
Hutchinson, Col. A. R. E., Political Agent, Morar, Gwalior	1862
Hutchison, J. H. Esq., Merchant, Calcutta ...	1870
Hurst, J. Esq., Mussoorie	1870
Hurrendhur Kishore Sing, Baboo, Betteah, Tirhoot ...	1870
Hyslop, Archibald, Esq., Merchant, Bimlipatam ...	1867

I.

Inskipp, C. T. Esq., Calcutta	1870
Irving, Dr. James, Civil Surgeon, Allahabad ...	1867
Irwin,† Lieut.-Col. W. Stud Dept.	1864
Isaac, Thos. S. Esq., Superintending Engineer, Cuttack...	1869
Ishore Persaud Narain Sing, Bahadoor, Rajah of Benares	1854

J.

JACK, E. A. Esq., Merchant, Calcutta ...	1863
Jackson, Hon'ble Elphinstone, Civil Service, Calcutta ...	1860
Jackson, Hon'ble L. S., Civil Service, Calcutta ...	1852
Jackson,† Dr. C. J., Civil Surgeon	1861

J.—(Continued.)

Admitted.

James, A. H. Esq., Assistant Commissioner, Naga Hills, Assam 1868
Jameson, W. Esq., M. D., Saharunpore 1852
Jennings, C. B. Esq., Sylhet 1862
Jennings, Saml. Esq., Allahabad, F. R. H. S. ... 1863
Joakim, H. J. Esq., Merchant, Calcutta ... 1865
Jogendronauth Mullick, Zemindar, Andool ... 1866
Jonas,† John Esq., Merchant 1867
Jones, W. H. Esq., Calcutta 1863
Jones, Frederick, Esq., Civil Service, Serampore ... 1870
Joy Sing,* Deo Bahadoor, Maharajah of Chikari .. 1868
Joykissen Mookerjee, Baboo, Zemindar, Ooterparah ... 1852
Judge, W. J. Esq., Solicitor, Calcutta 1858
Jung,* Bahadoor, Maharajah, G. C. B., Nepal ... 1860

K.

Kalee Kissen Tagore, Baboo, Calcutta ... 1869
Kally Prosono Roy, Baboo, Zemindar, Noral, via Jessore 1867
Kennedy, J. Pitt, Esq., Barrister-at-Law, Calcutta ... 1867
Khettermohun Sing, Baboo, Dinagepore 1870
Kimber, James Esq., Midnapore 1865
Kincaid, Major W. Assistant Political Agent, Indore, Central India 1867
King, R. W. Esq., Bengal Police, Ranchee, Chota Nagpore 1861
Knowles, H. Esq., Merchant, Calcutta 1852
Knyvett, Capt. W. L. N., District Supdt. of Police, Berhampore 1864
Koomudnauth Roy, Coomar, Natore 1866
Krauss, Henry, Esq., Rangoon 1865
Kristinder Roy, Rajah, Boliehar, Rajshaye ... 1866
Krugar, W. F. Esq., E. I. Railway, Patna 1867

Lagarde, F. Esq., Silk Manufacturer, Goorelee via Ghattal 1866
Lamb, E. Esq., Pursah Factory, Chumparun ... 1870
Lamouroux,† F. Esq., Merchant 1863
Lance, C. E. Esq., Civil Service, Berhampore ... 1858
Lance, G. Edwin, Esq., Civil Service, Cawnpore ... 1864
Landale, Geo. A. Esq., Indigo Planter, Turtipore, Maldah 1868
Landale, Alex Esq., Merchant, Calcutta ... 1869
Landale, B. R. Esq., Bhojepore Factory, Doomraon ... 1870

L.—(*Continued.*)

	Admitted.
Lane,† T. B. Esq., Civil Service	1855
Langlois, J. P. Esq., Tea Planter, Chittagong ...	1866
Larminie,† W. R. Esq., Civil Service	1862
Law, Walter James, Esq., Tea Planter, Seebsaugor ...	1867
Law, W. Trevor, Esq., Advocate, Moulmein	1870
Lawford, H. B. Esq., C. S , Jessore	1865
Leeds, Henry Esq., Conservator of Forests, Bengal, Calcutta	1868
Leibert, M. Esq., Tea Planter, Hazareebaugh ...	1868
Lees,† Col. W. N. LL.D.	1860
Leslie, S. J., Esq., Solicitor, Calcutta	1864
Levinge, H. Esq., C. E. Arrah	1863
Lewis, Hon'ble W. T. Resident Councillor, Penang ...	1840
Livesay, C. E. Esq., Tea Planter. Nutwunpore, Cachar ...	1868
Lloyd, M. Esq., Indigo Planter, Shapore Oondee, Tirhoot	1863
Lloyd, W. Esq., Darjeeling	1869
Loch, J. Esq., M. D., Civil Surgeon, Cawnpore ...	1859
Locke, H. H. Esq., Principal, Government School of Arts, Calcutta	1866
Logan, J. O. Esq., Indigo Planter, Midnapore ...	1867
Lord, G. F. Esq., Manager, Bengal Coal Company, Raneegunge	1858
Louis, J. Esq., Calcutta	1865
Lovell, Thos. Esq , Deputy Chief Engineer, Bareilly ...	1869
Lovell, Capt. H. P., Supdt., P. and O. Company, Calcutta	1870
Lowis,† E. E. Esq., Civil Service	1864
Lowis,† J. M. Esq., Civil Service	1865
Lowther,*† Robert, Esq., Civil Service	1836
Luchmeeput, Doogar, Banker, Calcutta	1864
Luchmessur Sing, Bahadoor, Zemindar, Mozafferpore, Tirhoot	1861
Lukin, Major F., 3rd Hussars, Ahmednuggur, Bombay ...	1860
Lushminarain, Lalla, Zemindar, Bareilly	1870
Lushington,† Edward, Esq , Civil Service	1848
Lushington, H. Esq., C. S. Gazeepore	1865
Lyall, R. D. Esq., Civil Service, Dacca	1869
Lynam, John Esq., Supdt., Reserve Police Force, Calcutta	1866

M.

MacDonald, M. N. Esq., Pertipore Factory, Sarun ...	1869
MacDonald, C. Esq., Dowlutpore Factory, viâ Roosa, Tirhoot	1867
MacDonald, W. J. Esq., Tea Planter, Assam ...	1867
MacDougall, Major W. C. Deputy Inspr. of Studs, Buxar	1867

M.—(Continued)

	Admitted.
Makeson, Major F. L. 2nd in Command, Kotra ...	1860
Mackillican, J. Esq,. Merchant, Calcutta	1865
Mackinnon, Capt., W. C. Dum-Dum	1870
Maclachlan, J. E. Esq., Calcutta	1861
Maclean, A. T. Esq., Civil Service, Baurisaul ...	1858
Macleod, Dr. Rodr. Civil Surgeon, Chuprah... ...	1869
Macleod, George Esq., Rampore, Beauliah	1858
Macmillan, J. Esq., C. E. Cuttack	1865
Macnaghten,† Capt. F. H., Stud Department ...	1864
Macnaghten, Chester Esq , Tutor, Rajkumar College, Rajkote, Kattywur	1869
Macneill, Lieut. Duncan, 41st M. N. I., Cuttack ...	1869
Macpherson,† Hon'ble A. G , Judge of the High Court ...	1867
Macpherson, W. Esq., Civil Service, Cuttack ...	1861
Macpherson, *† George, G. Esq	1836
Maharaj,* Dheraj Matabchunder Bahadoor, Rajah of Burdwan	1836
Maharajah* of Johore	1868
Maharajah of Betteah, Tirhoot	1870
Maharajah of Bhurtpore	1865
Maharajah of Cooch Behar	1864
Mahomed Alli Khan, Moonshee, Government Pleader, Dinagepore	1866
Mahony, H. C. Esq., Dhurrumkhole Factory, Silchar, Cachar	1869
Mainwaring, Col. R. R. 6th European Regt., Cawnpore ...	1861
Manager, Chundypore Tea Company, Cachar ...	1862
Manager, Kanchunpore Tea Company, Cachar ...	1862
Manager, Victoria Tea Company, Cachar	1862
Manager, Bengal Tea Company, Cachar	1864
Manager, East India Tea Company, Assam ...	1865
Manager, Dahingeapore Factory, Assam	1865
Manager, Bowalea Factory, Cachar .	1865
Manager, Koeyah Factory, Cachar	1865
Manager, Goomrah Factory, Tirhoot .. .	1865
Manager, Narainpore Garden, Cachar	1865
Manager, Joypore Garden, Cachar	1865
Manager, Cutlee Cherra Garden, Cachar	1865
Manager, Lower Assam Company, Gowhatty ...	1865
Manager of Raj Shewhur, Tirhoot	1870
Manager, Noakacharee Tea Company, Assam ...	1865
Manager, Public Garden, Bareilly	1868
Manager, East India Tea Company, Cachar	1866
Manager, Koomtar Tea Garden, Assam	1869
Manager, Chincooree Tea Estate, Cachar	1870

M.—(*Continued.*)

	Admitted.
Mackinnon, Captain W. C., Dum-Dum ...	1870
Mandelli, L. Esq., Tea Planter, Darjeeling	1868
Manikjee,* Rustomjee, Esq., Merchant, Calcutta ...	1837
Manook, Dr. S. J., Civil Surgeon, Chyebassa ...	1866
Marinden, H. C. Esq., Barrister-at-Law, Calcutta ...	1869
Markby, Hon'ble W., Judge of High Court, Calcutta ...	1866
Marquard,† C. Esq., Merchant	1862
Martin, R. L. Esq., Inspector of Schools, Midnapore ...	1867
Martin, W. R. Esq., Tea Planter, Punkabaree, Darjeeling	1868
Marsden, F. J. Esq., Barrister, Calcutta ...	1870
Maseyk, J. W. Esq., Indigo Planter, Jungypore ...	1858
Masters,*† J. W. Esq.	1835
Mayne, F. O. Esq., C. B., Civil Service, Allahabad ...	1869
Maunsell, Lieut. F. R., Chukrata	1870
McAlpine, Robert Esq., Futtickcherry Estate, Chittagong	1865
McDonell,† W. F. Esq., Civil Service ...	1866
McFarlane, A. C. Esq., Merchant, Calcutta ...	1870
McLeod, Sir Donald Frield, Lieutenant-Governor, Punjab, Lahore	1836
McMullin, Major C. N., Bengal Staff Corps, Umballa ...	1870
Meres, W. F. Esq., Civil Service, Hooghly ...	1870
Mercer, Lieut.-Col. T. W. Dhurumsala	1866
Mercer,* G. G. Esq., Indigo Planter, Futtyghur ...	1846
Mesurier, C. B. Le, Esq., Mirzapore ...	1861
Meugens, J. G. Esq., Merchant, Calcutta ...	1865
Millar, Major F. J., Deputy Commissioner. Sealkote ...	1869
Millard, Captain W. S., Supdt., Calcutta Docking Company, Calcutta	1864
Miller, Edward Esq., Merchant, Calcutta ...	1856
Millie, W. J. Esq., Tea Planter, Chittagong ...	1866
Mills,*† Andrew John Moffat, Esq.	1836
Minchin, F. J. V. Esq., Aska	1862
Minchin, Charles Esq., Merchant, Bimlipatam ...	1864
Minto, W. Esq., Dhera Doon	1862
Mitchell, R. Esq., Merchant, Calcutta	1868
Mohes Chunder Banerjee, Baboo, Cuttack	1869
Mohima Rungun Roy Chowdry, Zemindar, Kakinia, Rungpore	1875
Molony, E. Esq., C. S., Cuttack	1866
Money,*†W. James Henry, Esq., Civil Service ...	1837
Money,† Captain R. C., Deputy Commissioner ...	1860
Moody, John, Esq., Raneegunge	1870
Moore, C. W. Esq., C. S., Azimghur ...	1865
Morris,† J. H. Esq., Civil Service	1863

M.—(Continued.)

Admitted.

Mordan Alie Khan, Mahomed, Prime Minister, Marwar, Jodhpore	1870
Moran, F. C. Esq., Manager, Rungorah Factory, Debroghur	1870
Mosely, T. H. Esq., Merchant, Calcutta ...	1862
Mowbray, Arthur H. Esq., Merchant, Calcutta ...	1866
Muir, Hon'ble Sir W., K.C.S.I., Lieutenant-Governor of N. W. P., Allahabad	1869
Murray, Col. J. H., Commandant, 14th Bengal Cavalry, Deolee	1867
Murray, Capt. W. G., Revenue Survey, Calcutta ...	1870
Murdoch, A. W, Esq., C. E., Serajgunge ...	1870
Muspratt, J. R. Esq., Civil Service, Purneah ...	1847

N.

NAESMYTH, J. Esq., Civil Service, Hissar ...	1852
Nawab, Nazeer Ally Khan Bahadoor, Calcutta ...	1862
Nembhard, Major W., Commissioner, East Berar, Oomraotee	1861
Newton, Thos. Esq., Barrister-at-Law, Allahabad ...	1870
Nickels, C. Esq., Indigo Planter, Shumuskhanpore Factory, Jaunpore	1866
Niladhur Singh Deo, Rajah Bahadoor, Sonepore, Sumbulpore	1870
Nobin Chunder Nag, Baboo, Zemindar, Midnapore ...	1866
Noble, Lieut., C. S., Assistant Settlement Officer, Fyzabad, Oude	1870
Norman, Hon'ble J. P., Judge of the High Court, Calcutta	1865

O.

OBOYCHURN Goho, Baboo, Merchant, Calcutta ...	1856
Ogbourne, C. H. Esq., Calcutta	1867
Ogilvy, J. F. Esq., Merchant, Calcutta ...	1865
Oldham, Wilton Esq., L.L.D., Civil Service, Ghazeepore...	1867
Onraet, P. T. Esq., Bhaugulpore	1857
Onasch, Revd. H., Purulia, Manbhoom ...	1869
Orr, J. Cave Esq., Solicitor, Calcutta ...	1868
Orr, Major Alexander, P., Roy Bareilly, Oude ...	1868
Osborne,† Major Willoughby, F.R.G.S., F.G.S. ...	1862

O.—(*Continued.*)

Admitted.

Osborne, Captain J. H. Willoughby, Revenue Survey, Debrooghur 1870
Owen, Lieut.-Col. W. G., (12th Madras N. I.) Tonghoo, via Rangoon 1846
Owen,† Lieut.-Col. A. W. Executive Engineer ... 1865

P.

PALMER, Charles, Esq., Medical Service, Calcutta ... 1848
Palmer,*† T. A. G., Esq. 1861
Park, Robert Esq., Indigo Planter, Colgong ... 1865
Parrott, Lieut.-Col. B., Stud Dept., Kurnaul ... 186
Paske, Dr. C. T., Civil Surgeon, Mirzapore ... 186
Payne, Dr. A. J., Medical Service, Calcutta ... 186
Payne, H. F., E. B. Railway, Sealdah ... 186
Peal, S. E. Esq., Tea Planter, Sapakattee, Seebsaugor, Assam 186
Pearce, Geo. S. Esq., Manager Monierkhal Garden, Cachar 187
Pearl, J. Esq., Tea Planter, Debrooghur 187
Phear, the Hon'ble J. B., Calcutta 186
Peary Mohun Banerjee, Baboo, Pleader, High Court, N. W. P., Allahabad 186
Peddie, Graham, Esq., District Engineer, E. I. Railway, Allahabad 186
Pellew, F. H. Esq., Civil Service, Hooghly ... 186
Peppe, T. F. Esq., Chota Nagpore 186
Perkins, Dr. R. H., Benares 185
Perrin, Monsieur J., Silk Filatures, Berhampore ... 185
Pertap Narain Sing, Baboo, Deputy Magistrate, Bood-Bood 186
Pester, Lieut.-Col. Hugh L., 9th Regiment N. I., Barrackpore 1862
Peterson,† A. T. T. Esq., Barrister, High Court ... 1849
Peterson, Frederick Esq., Secy., Simla Bank, Simla ... 1862
Phillippe, Clement Esq., Indigo Planter, Balacole, Pubna 1851
Phillips, James Esq., Indigo Planter, Shikarpore via Koosteah 1858
Phillips, A. Esq., Barrister-at-Law, Calcutta ... 1870
Pickance, Lieut. W. John, Madras Staff Corps, Russelkundah, Ganjam District 1864
Pigott, William Esq., Broker, Calcutta ... 1864
Pittar, C. J. Esq., Solicitor, Calcutta ... 1866
Place,† H. J. Esq., Broker 1867
Plowden, W. C. Esq., Civil Service, Allahabad ... 1869
Pogose, J. G. N., Zemindar, Dacca 1856

P.—(Continued.)

Admitted.

Pollok, Major F. T., (Madras Army) Executive Engineer, Gowhatti 1860
Porter, G. E. Esq., Civil Service, Rungpore ... 1863
Poulton, Major H. B. A., Bengal Staff Corps, Saugor ... 1865
Power, A. W. B. Esq., C. S., Tajpore, Tirhoot ... 1869
Pott, A. C. Esq., Merchant, Calcutta 1870
Poorna Chunder Roy, Zemindar, Sarapoolly ... 1870
Pratapa Chandra Ghosa, Baboo, Calcutta ... 1869
Prentis, C. Esq., Civil Surgeon, Gorruckpore ... 1866
Prestage, Franklin, Esq., C. E., Sealdah 1870
Prior, General Chas., Commanding at Dhurmsalla ... 1867
Proprietors Jugdispore Estate, Beeheea, Shahabad ... 1869
Protheroe, Lieut. Montague, Madras Staff Corps, Assistant Superintendent of Port Blair 1869
President, Municipal Committee, Allyghur 1870
Price, Charles E. Esq., Calcutta 1870
Pringle, R. B. Esq., Badalipar Tea Garden, Assam ... 1870
Prinsep, H. T. Esq., Civil Service, Patna 1870
Punchanana Mitter Baboo, Calcutta 1870
Pyne, R. Esq., Purneah 1867

Q.

Quinton, J. W. Esq., Civil Service, Lucknow ... 1865

R.

Raban, Lieut.-Col. H., Bhaugulpore 1858
Rajah of Bhadawar, Agra 1869
Rajkissen Mookerjea,* Baboo, Landholder, Ooterparah ... 1836
Ramdass Sen, Baboo, Zemindar, Berhampore ... 1869
Ram Rungun Chukerbutty, Zemindar of Heetapore, Beerbhoom 1869
Ramanauth Tagore, Baboo, Calcutta 1842
Ramanymohun Chowdry, Baboo, Zemindar, Rungpore ... 1861
Ramessur Roy Chowdry, Baboo, Zemindar, Allahabad ... 1868
Ramsay,† Colonel George 1855
Ravenshaw, T. E. Esq., Civil Service, Cuttack ... 1865
Redpath, R. Esq., Assistant Superintendent of Police, Mergui 1868
Reid † F. Esq., Supdt. of Irrigation 1858
Reid, J. R. Esq., C. S., Azimgurh 1866
Reinhold, H. Esq., Merchant, Calcutta 1862
Riach, F. S. M. Esq., Rosekandy. Cachar 1870
Richards,*† J. Esq., Merchant 1834
Richardson,† H. Esq., C. S. 1865

Admitted.

Riddell,† H. B. Esq., Civil Service 1855
Ridge, W. Esq., Furreedpore, via Berhampore ... 1866
Ripley,† Lieut.-Col. F. W. 1849
Robarts, Lieut.-Col. Charles, Commandant, 17th Bengal Cavalry, Seetapore 1862
Robarts, H. Esq., Indigo Planter, Bellah, Allyghur ... 1870
Roberts, Robert Esq., Chief Auditor, E. I. R., Calcutta ... 1870
Robertson, J. C. Esq., Civil Service, Allahabad ... 1870
Robinson, S. H. Esq., Merchant, Calcutta ... 1854
Robinson,† J. Hamilton, Esq., Merchant 1863
Robinson,† W. Esq., District Engr., Delhi Railway ... 1867
Robinson, James Esq., C. E., Officiating Exe. Engineer, Bareilly 1869
Robinson, Revd. Julian, Allahabad 1869
Rochfort, W. B. Esq., District Supdt. of Police, Howrah 1868
Rogers, Arcbd. Esq., Solicitor, Calcutta 1858
Roghoonundun Sing, Rajah, Soorsund, Tirhoot, ... 1868
Roordur Purtab Sing,* Rajah Bahadoor, Dewan of Punna 1868
Roodurpurshand Chowdry,* Napore, Tirhoot ... 1867
Roquet, V. Esq., Indigo Planter, Moharagunge Factory, Azimghur 1860
Ross,‡ George Esq., Merchant 1862
Ross, Mars Esq., Merchant, Calcutta 1865
Row, Col. W. S. (33rd N. I.) Lucknow 1854
Ruddock, E. Esq, B. C. S., Durbunga, Tirhoot ... 1868
Russell,† T. M., Esq. 1868
Ruxton, G. Esq., Merchant, Calcutta 1861
Ryder,† Lieut.-Col. S. C. D. 1858

S.

SAGORE, Dutt, Baboo, Merchant, Calcutta 1850
Samachurn Law, Baboo, Merchant, Calcutta ... 1855
Samuells, Captain W. L., Assistant Commissioner, Chota Nagpore 1870
Sandeman, H. D. Esq., Civil Service, Calcutta ... 1863
Sandys, Mrs. Annie, Bhaugulpore ... 1870
Sandys, E. F. Esq., Chuprah 1870
Savi, J. R. Esq., Indigo Planter, Nohatta, Jessore ... 1862
Savi, Thomas, Esq., Indigo Planter, Kishnaghur ... 1851
Sceales, Jaffray, O'Brien, Esq., Catchecutta Factory, Alumdanga, E. B. Railway 1869
Schiller,† F. Esq., Merchant 1854
Scott, P. G. Esq., Assistant Superintendent of Police, Bugutpore, Dhursing Surria, Tirhoot ... 1869

S.—(Continued.)

	Admitted.
Scott, Capt. G. J , Superintendent, I. G. S. N. Company, Calcutta	1870
Searles, Major, Geo. A., Madras Staff Corps, Executive Engr., Irrigation Dept., Barrackpore	1868
Secretary, Local Committee, Mynporee	1850
Secretary, Local Fund Committee, Umritsur ...	1859
Secretary, Local Fund Committee, Ferozepore ...	1861
Secretary, Public Garden, Banda	1855
Secretary, Public Garden, Monghyr	1853
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Secretary, Agri. and Hort. Society, Saugor	1863
Secretary, Cantonment Public Garden, Agra ...	1865
Secretary, Local Fund Committee, Goorgaon ..	1865
Secretary, Assam Company, Calcutta	1865
Secretary, Public Garden, Jaloun, Oorai	1866
Secretary, Govt. Garden, Muttra	1866
Secretary, Local Committee, Chindwarrah . ..	1867
Secretary, Local Committee, Jahnsie	1867
Secretary, Local Fund Committee, Baitool	1869
Secretary, Local Fund Committee, Mozuffergurh ...	1869
Secretary, Local Fund Committee, Raepore ...	1865
Secretary, Municipal Committee, Mirzapore ...	1869
Secretary, Road Fund Committee, Jaunpore ...	1867
Secretary, Port Canning Company Ld., Calcutta ...	1868
Secretary, Local Committee, Chanda	1870
Secretary, Municipal Committee, Jhung ...	1870
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Shearin, E. Esq., Merchant, Calcutta	1856
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Shillingford, G. W. Esq., Kolasay Factory, Purneah ...	1867
Shortt,† T. H. H. Esq., Civil Service	1866
Showers, Lieut.-Col. C. L., Gwalior	1863
Sibley, George Esq., Civil Engineer E. I Railway, Calcutta	1869
Simons, C. J. Esq., Tea Planter, Busella Factory via Seebsaugor, Assam	1863
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Simson, James, Esq., Civil Service, Mirzapore ...	1856
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Smith, Thomos T. Esq., Rampoorah Factory, via Jeagunge	1864
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Smith, Revd. James, Delhi	1866
Smith, W. H. Esq., Civil Service, Allyghur	1868
Smith, Maxwell Esq., Hursingpore, Tirhoot	1869
Smyth, Capt. R. G., R. E., Hazareebaugh	1863
Spankie, Hon'ble R., Civil Service, N. W. P., Allahabad	1865
Spearman, Lieut. Horace, Asst. Commissioner, Rangoon	1865
Spencer, C. J. Esq., C. E., E. I. Railway, Ucharah ...	1863
Spicer, A., Esq., Tea Planter, Cachar	1869
Stack,† R. F. Esq., Solicitor	1862
Stalkartt, William Esq., Merchant, Cal., (*Vice-President*)	1845
Stalkartt, J. Esq., Merchant, Calcutta	1863
Steel, Donald, Esq , Eastern Cachar Tea Company, Cachar	1861
Steel, Lieut.-Col. J. A., Bengal Staff Corps, Roy Bareilly, Oude	1868
Steel, Lieut. E. H., R. A., Revenue Survey, Suddia, via Debrooghur, Assam	1870
Stephen, J. Esq., Dacca	1855
Stephenson, Cecil Esq., Agent, E. I. Railway, Calcutta ...	1866
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Stevens, H. W. Esq., Executive Engr., Durbangah ...	1867
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Stewart, A. Esq., Manager, Oornabund Garden, Cachar ...	1870
Stewart, R. D. Esq., Raneegunge	1870
Stirling, A. Esq., Merchant, Calcutta	1866
Stokes,‡ Allen Esq., E. I. Railway	1867
Stocks, J. W. Esq., Gonatia, Synthia	1866
Stoney, R. V. Esq., Civil Engineer, Ungool via Cuttack	1866
Stoney, T. Butler, Esq., C. E., Mozufferpore Tirhoot ...	1869
Strachey† Lieut.-Col. R. (Engineers)	1857
Strand, A. Esq., Stock Broker, Calcutta ...	1870
Stuart, Alex. Esq., Raneegunge	1863
Stubbs, Lieut.-Col. W. H., 4th Regt. N. I., Allahabad ...	1868
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Sturmer, A. J. Esq., Talooka Kojha, viâ Gazeepore ...	1866
Supdt. of Jorehaut Tea Company, Assam ...	1865
Supdt., Northern Assam Tea Company	1865
Supdt. Serajgunge Jute Company, Serajgunge ...	1868
Sutherland, Charles J. Esq., Merchant, Calcutta ...	1838
Sutherland,† Dr. John	1859
Sutherland,† H. C. Esq, Civil Service	1860
Sutherland, H. H. Esq., Merchant, Calcutta ...	1870
Sutherland, A. B. Esq., Merchant, Calcutta ...	1870
Suttyanund, Ghosal, Rajah,* Bhookoyelas... ...	1869
Swinden, T. G. Esq., Calcutta...	1855
Swinhoe, William Esq., Attorney, Calcutta	1859
Sykes, Arthur L. Esq., Merchant, Calcutta	1869
Syooddeen Ahmud Allee Khan, Bahadoor, Nawab of Moorshedabad	1868
Syud Ahmed Ally,† Nawab	1864

T.

TARRUCK Nauth Dutt, Baboo, Calcutta	1866
Taylor, V. T. Esq., Civil Service, Bhagulpore ...	1860
Taylor, W. C. Esq., Cuttack	1858
Taylor, Frank, Esq., Executive Engineer, E. I. Irrigation and Canal Company, Hidgelee	1868
Temple, the Hon'ble Sir R., K.C.S.I., Calcutta ...	1869
Tennant, Major T. E., Deputy Inspr. General of Police, Waltair, Vizagapatam	1868
Terry, W. Esq., Indigo Planter, Midnapore	1846
Thelwall, Col. J. B., C. B., Meean Meer	1851
Thomas, R. M. Esq., Solicitor, Calcutta	1849
Thomas, J. Esq., Merchant, Calcutta	1867
Thomas, J. P. Esq., Merchant, Calcutta	1868
Thompson, Lieut.-Col. E., Political Agent of Bhopaul ...	1864
Thompson, Rivers Esq., Civil Service, Calcutta ...	1864
Thompson,* Dr. R. F., Hooghly	1865
Thompson, A. B. F. Esq, Calcutta	1869
Thompson, Henry, Esq, Manager, Moran Tea Company, Seebsaugor, Assam	1870
Thomson, Ninian, Esq., Judge, S. C. Court, Calcutta ...	1862
Thorpe, J. Esq., Lucknow	1867
Tonnerre, Dr. C. Fabre, Health Officer, Calcutta, (*Vice-President*)	1862
Toomly, Geo. Esq., Indigo Planter, Contai, Tirhoot ...	1870
Tovey, Capt. J. T., Exe. Engineer, Cawnpore ...	1866
Trafford, Revd. John, Serampore	1863

T.—(Continued.)

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Trannath Chatterjea, Baboo, Calcutta	1865
Travers, Major-General James, V. C., Allahabad ...	1869
Tregear, Richd., Esq., Kolinjura, Jaunpore ...	1866
Tucker, W. T. Esq., Civil Service, Bancoorah ...	1855
Tucker, Robert Esq., Tea Planter, Seebsaugor ...	1867
Tulloch, Capt. A., Dist. Supdt. of Police, Kamroop ...	1865
Turnbull, C. S. Esq., Silk Manufacturer, Ghuttal ..	1852
Turnbull, the Hon'ble G. D., Civil Service, Meerut ..	1865
Turnbull, Robert Esq., Merchant, Calcutta ...	1865
Turner, H. B. H. Esq., Merchant, Calcutta ..	1868
Turner, Hon'ble C. A., Allahabad	1869
Turner, H. G. Esq., Madras Civil Service, Bimlipatam ...	1869
Twynam, Capt. E. J. L., Executive Officer, Thayet Myo...	1857
Tytler, Col. R. C., Simla	1867

U.

Unwin, Howard, Esq., C. E., Irrigation Dept., Burdwan...	1869

V.

Vancutsem, E. C. Esq., Merchant, Calcutta ...	1868
Veen, W. Ter, Esq., Merchant, Calcutta	1864
Vertannes, J. C. Esq., Civil Engineer, Contai ...	1865
Vizianagram, His Highness the Rajah of	1847
Voigt, S. E. Esq., Merchant, Calcutta	1870
Voss, C. W. Esq., Merchant, Gopalpore	1864

W.

Wagentreiber, W. Esq., Tea Planter, Debrooghur ...	1857
Wagentrieber, W. J. H. Esq., Sonarie, Seebsaugor, Upper Assam	1868
Walker,† G. A. Esq., Tea Planter	1861
Walker,† A. Esq., Merchant, Calcutta	1867
Walker, William Esq., Tea Planter, Seebsaugor, Upper Assam	1870
Walker, Capt. R. J., Bengal Staff Corps, 17th N. I., Delhi	1870
Wallace, Adolphus Esq., Rungajaun Factory, Golaghaut, Assam	1866
Walton, Lieut.-Col. B., Military Store-keeper, Calcutta ...	1867
Ward, J. D. Esq., Civil Service, Purneah	1869
Ward, Lieut.-Col. W. J., 8th Bengal Cavalry ...	1870
Ward, L. Esq., Chief Accountant, E. B. Railway, Sealdah	1870
Warneford, Revd. T. L. J., Port Blair	1866
Warner, Thornton Esq., Emigration Agent for Trinidad, Kidderpore	1867

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Waterfield,† E. Esq., Civil Service	1846
Waterfield, William Esq., Civil Service, Allahabad ...	1870
Wauchope, S. Esq., Civil Service, Hooghly	1848
Wavell,† W. Esq., Civil Service	1859
Webber, F. V. B. Esq., Civil Surgeon, Dinagepore ...	1868
Webster, H. B. Esq., Civil Service, Saharunpore ...	1864
Webster, Geo. K. Esq., Civil Service, Chota Nagpore ...	1866
Webster, Alex. L. Esq., Jorehaut	1867
Weinholt, John Esq., Merchant, Calcutta	1869
Wemyss, Sir John, Bart, Mirzapore	1859
Weskins, Charles Esq., Merchant, Calcutta	1854
Westmacott, E. V. Esq., C. S., Dinagepore	1866
Weston, John Esq., Judge S. C. Court, Magoorah ...	1863
White, Robert Esq., Tea Planter, Cachar	1869
Whitty, Irwin J. Esq., Civil Engr., E. I. Railway Chord Line, Kurmaton, Assensole	1867
Wickes, Haines Esq., Exe. Engr., Berhampore ...	1866
Wight,*† Robert Esq., M. D.	1836
Wilcox, Frederick Esq., Bengal Police, Pooroolia ...	1867
Wilkinson, Major A. E., Cantonment Magte., Lucknow ...	1862
Wilkinson, C. J. Esq., Barrister-at-Law, Calcutta ...	1870
Williams, Walter, Esq., Supdt., Dist. Police, Etah ...	1867
Williamson,† Major James, ...	1849
Williamson,† Lieut. W. J.	1867
Wilmot,† C. W. Esq., Asst. Commissioner, Sonthal Pergunnahs	1859
Wilson, A. G., Esq., Deputy Magistrate, Burhee ...	1847
Wilson† Charles Esq., Surgeon, 8th N. I.	1860
Wilson,† Lieut.-Col. H. M.	1860
Wilson, C. H. Esq., Merchant, Calcutta	1868
Wilson, H. F. Esq., Serajgunge	1870
Windle, J. A. Esq., C. E., Executive Engineer, Calcutta ..	1865
Wintle, Charles F. Esq., Sub-Deputy Opium Agent, Gorruckpore	1859
Wintle, Capt. H. R., 18th N. I., Gorruckpore ...	1870
Wintle, Col. E. H. C., Cantonment Joint-Magistrate, Dum-Dum, (*Vice-President*)	1860
Wood, James M. Esq., Nagagollie, Debrooghur, Assam ...	1865
Wood, C. C. Esq , Assistant Commissioner. Rajmehal ...	1870
Woodbridge, George, Esq., Civil Engineer, Oude and Rohilkund Railway, Bareilly	1869
Woodcock, Lieut. E. M., District Superintendent of Police, Seetapore, Oude	1864
Woodford, Dr. O., Calcutta	1863
Wordie, T. H. Esq., Merchant, Calcutta	1863
Worgan, J. B. Esq , C. S., Purneah	1868

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Wright, H. Esq., Shapore, Punjab	1854
Wright, A. C. Esq., Deputy Magistrate, Raneegunge ...	1865
Wright,† Dr. Daniel	1866
Wright, W. Esq., Judge, Small Cause Court, Cuttack ...	1866
Wroughton, Major H. R. Offg. Deputy Asst. Commissary General, Morar, Gwalior	1860

Y.

YATES, B. J. Esq., Station Master, E. I. Railway, Howrah	1868
Young, W. Esq., C. S., Goruckpore	1868
Young, James Esq., Merchant, Calcutta	1869

Agricultural and Horticultural Society of India.

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ON THE

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2. The laying out of a Garden.

3. Preparation of the soil, sowing of the seed, either in nurseries or in *situ*.

4. Transplanting, and the effects of the use of manure.

5. Hoeing and weeding.

6. Pruning—the best mode of.

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8. Labor—management of—with details as to apportioning of work, payments and advances.

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10. Box-making—machinery—to simplify and cheapen its cost, packing, leading, stamping and preparing for shipment.

11. Seed, plucking, drying, transport,—best mode of preserving, and its utilization when not saleable.

12. Management—best mode of—as respects labor, accounts, forms, adjustment of advances, &c.

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A. H. BLECHYNDEN,
Secretary.

TREATMENT OF SEEDS

Agricultural and Horticultural Society

OF

INDIA.

The Society will thankfully accept all such back Nos. of its Journal and other publications, as may not any longer be required by its Members.

A. H. BLECHYNDEN,

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CALCUTTA,
19*th September*, 1871.

10. Box-making—machinery—to simplify and cheapen its cost, packing, leading, stamping and preparing for shipment.

11. Seed, plucking, drying, transport,—best mode of preserving, and its utilization when not saleable.

12. Management—best mode of—as respects labor, accounts, forms, adjustment of advances, &c.

TREATMENT OF SEEDS.

Affected by damp or moist atmospheric influences arising from long and continuous rain.

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1. Put a little *quicklime* into each packet, keeping the packet in a dry airy room until required to be sown.

2. The *quicklime* has a strong affinity for carbonic acid, which will at once act upon the seeds and remove the superabundant carbonic acid which they have absorbed in a moist atmosphere.

3. It is particularly requested, that members and the public generally, who resort to the treatment above recommended, will do the Society the favor to report specially the result of the experiment, and in cases of failure, to note or remark on the supposed cause of failure.

METCALFE HALL:
Calcutta, 22nd September, 1871.

A. H. BLECHYNDEN,

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JOURNAL

OF THE

Agricultural and Horticultural Society

OF

INDIA.

Notes on Horticulture in Bengal, (No. 3). By JOHN SCOTT, Esq., *Curator of the Royal Botanic Gardens, Calcutta.*

No. III.—ORCHIDACEÆ, THE ORCHID ORDER.

1.—*General remarks on the culture of Orchids in Bengal.*

THE genera of which I have now to treat, form an extensive, well characterised and widely-distributed natural order, admired by all who have an eye to nature's works, for the beauty and odd forms of their flowers, which as Lindley remarks, "represent an insect, sometimes a helmet with the visor up, and are so various in form, that there is scarcely a common reptile or insect to which some of them have not been likened." They consist of perennial herbaceous plants

and shrubs, growing in the soil (terrestrial) in temperate climes, as they are also found in warmer latitudes, though then, more generally, assuming an epiphytic habit and fixing themselves upon the loftiest trees, or finding congenial habitats in crevices, or on the surfaces of bare rocks, &c. Though thus varied in their habitats, and widely diffused in all low and temperate latitudes, they avoid the excessively dry regions of the Tropics, and are all but eliminated from those characterised by extremes of temperature. They are found, says Lindley, "in almost all parts of the world, except upon the verge of the frozen Zone, and in climates remarkable for dryness. In Europe, Asia and North America, they are seen growing everywhere, in groves, in marshes, and in meadows; in the drier parts of Africa, they are either rare or unknown; at the Cape of Good Hope, they abound in similar situations as in Europe; but in the hot damp parts of the West and East Indies, in Madagascar, and the neighbouring islands, in the damp and humid forests of Brazil, in the warm mild parts of Central America, and Western Mexico, in the damp tropical parts of India, and on the lower mountains of Nipal, the orchidaceous plants flourish in the greatest variety and profusion, no longer seeking their nutriment from the soil, but clinging to the trunks and limbs of trees, to stones and bare rocks, where they vegetate among ferns and other shade-loving plants, in countless thousands. Of the epiphytal class, one only is found so far North as South Carolina, growing upon the branches of the Magnolia, if we except the species from Japan, a country which has a climate peculiar to itself, among regions in the same parallel of latitude. The most southern stations are those of *Earina mucronata* in New Zealand, in lat. 35° S., and of *Gunnia Australis* in Emu Bay, Van Dieman's Land, lat. 41° S. Ample details respecting their distribution in Australia are given by A. Cunningham, in the *Botanical Register* for 1843.

Lower Bengal with its annual sequence of cold, hot, and

rainy seasons, is by no means favourable to Orchid growth, and accordingly we find them poorly represented in species, though of these, a few are rather abundant in individuals. In the immediate vicinity of Calcutta, the following species occur: those of an epiphytic habit are *Vanda Roxburghii*, *Acampe papillosa*, and *Cymbidium aloifolium*, the two first being especially abundant on mango trees. The terrestrial species are *Geodorum purpureum*; *Eulophia campestris*; *Habenaria commelinifolia*, *plantaginea* and *marginata*, (the latter rare); *Pogonia juliana*, *carinata* and *plicata*; *Didymoplexis pallens* (very rare), and *Zeuxine sulcata*, the "Shwet-Hoolee" of the Bengalees and one of the few orchids to which they have given a specific name. It is very abundant on undisturbed pasture lands; speckling them with a snowy whiteness during its flowering period, in December and January. The generic name of the *Vanda Roxburghii* is directly from the Sanscrit, and that under which the plant is known to the natives of Bengal; though the same word is indifferently applied to all parasitic or epiphytic plants. As it is chiefly found on the mango, the "Ahm" of the Bengalees, it has been called the "Amra-Vanda."

The sparsity of really indigenous species; and these (with the three above noted exceptions) reduced to those terrestrial sorts which are alone represented in temperate climates; sufficiently indicates the ungenialness of this part of Bengal for orchid cultivation. This has, indeed, been so strongly felt, that until lately even our most ardent amateurs had despaired of ever attaining any success in their culture here, and in general consoled themselves with annual receipts of plants from their native wilds in the cold season; and many of which flowered satisfactorily, by the beginning of the subsequent hot season. Blossoming however to the majority proved but the last effect of an expiring vitality; few regained their verdance, and yet fewer ever again refreshed the eye of their cultivator with a second season's bloom. This, I may state, was much

the condition in which the generality of orchids existed in Calcutta Gardens, until the cold season of 1866, when the success attending their cultivation in those thinly-thatched structures used by the native betel-grower for his "pan", *Piper Betel*, had been fairly shown by the improved condition of the collection in the Botanical Gardens here. These structures modify very effectively the ungenialities of climate, with which we have here to contend, screening them in the cold season and checking the intense nocturnal radiation which then prevails; while in the hot season, admitting a light diffused as that of their native forests, and thus requiring but a free supply of water, to afford that degree of humidity as the complement of their wants during the season of growth, and which is fully and naturally supplied throughout the rainy season. Their application to orchid culture is due to the late Superintendent of the Botanical Gardens, (Dr. T. Anderson)—whose premature death has deprived Indian Botany of one of its most accomplished investigators, and Indian Horticulture of the invaluable services of an earnest patron—who had them erected for the first time in the gardens here in 1865. The taste for orchids has been thereby greatly popularized, and there are now not a few amateur collections in Calcutta and its vicinity, which would lose nothing by a comparison with some of the better private collections in Europe.

The accommodation for orchids in the Botanical Gardens here, consists of two houses, the one a show-house, the other for the propagation and establishment of newly-introduced species. The show-house is 80 feet long by 70 in breadth, with a flat roof, at an elevation of 7 feet. The roof is supported on cast-iron pillars, sunk in masonry, at distances of 14 feet, between which again stout posts of teak-wood are fixed, forming the lines of passages, and which, while strengthening the structure, afford additional surfaces for orchid culture; affording in due course an enlivening display of bloom. Over these posts teak rafters ($2\frac{1}{2}$ by 1 inch) are fixed diago-

nally, and overlaid by stout bamboo rods, at distances of two feet. The latter consist of ordinary sized bamboos split longitudinally into four parts, and form the basis for a light frame-work of bamboos, on which dried Ooloo grass—*Imperata cylindrica*—is thinly strewed, and bound down with other rods of bamboo. The flat roof thus covered, is of course preferable to one with any degree of slope, as affording the least collecting surface for rain, and dispersing it to the plants below, most naturally and equably. The sides of the house are very similarly constructed, and even more thinly covered with grass, and on this part the Kash—*Saccharum spontaneum*—as being much longer than the Ooloo, is preferable. In both positions, the grass should be disposed so as to cut off all direct solar rays, while inducing a scarcely appreciable degree of darkness. Tropical orchids, with few exceptions, delight in an abundance of light and heat, but in their season of growth they none the less require a highly humid atmosphere; and thus, in the construction of our orchid houses, it should be our aim to afford screens which, while securing the latter, also admit an abundance of sun-light and heat.

The staging of the house is constructed of split bamboos. There are four central tables, each of which measures 52 feet in length, by about 10 in breadth, and has a slightly elevated portion in the centre for the larger plants; the intervening passages are 4½ feet broad, edged, and floored with bricks, and covered with kunkur. Along the sides of the house, there are also tables of a similar construction, and four-and-a-half feet broad. These are devoted to terrestrial orchids, ferns, and begonias, all of which thrive well under the conditions of shade and humidity thereon afforded them. As the bamboo tables however rarely stand for more than two or three years, it is purposed to replace them by permanent platforms of masonry. In constructions of the above character, care should be taken that thoroughly matured bamboos, (which can

now rarely be had in the Calcutta market, under Rs. 25 per 100), only are used; as those of an immature character are quickly overrun by a small boring weevil, which in the course of a few months will reduce them to a minutely honeycombed-state. The durability of the bamboo is also much increased, by steeping them in water for some time, say at least 14 days previous to their being used.

The second or nursery house is of a similar construction to the above, with the exception of the posts which are all of the common Soondree, *Heritiera minor.* It is 40 feet long by 20 feet in width, the roof 6½ feet high, and supported on 15 Soondree posts. It has one central bamboo machan, or table 7½ feet broad, and two side ones, each 3½ feet in breadth; the intervening passages each about 2½ feet. The cost of material and labour for the construction of a house of the above description and dimensions is as follows:

	Rs.	As.	P.
100 Bamboos	25	0	0
15 Soondree posts	8	0	0
32 lbs. Coir Twine	3	0	0
Ooloo grass	2	0	0
Bricks and Kankur for paths	3	4	0
Labour	7	0	0
Total cost	48	4	0

With regard to the cultivation and management of orchids, we may be guided by the conditions under which we find them (not only living but really flourishing) in their native habitats; for it is well to remember, that the conditions under which plants are frequently found in nature, are by no means, or at least not necessarily the most suitable for their healthy development: in that unrelaxing struggle, individual against individual, the strongest only live, and these do not select the site they *would*, but that on which they *can* establish themselves. These condi-

tions for the generality of tropical orchids in this country (as I have previously remarked) are very perfectly afforded by the thatched houses above recommended. In these the plants are afforded their natural period of rest in the cold season, which extends from the beginning of November to the end of January, or middle of February. During this period, water (with few exceptions) should be entirely withheld, the fogs so common in the mornings and evenings, being quite sufficient to prevent any undue shrivelling in all non-deciduous species, whereas the naturally deciduous provided as they usually are with pseudo bulbs, stout, fleshy or gouty stems, resist perfectly any injurious effects, and indeed flower all the more freely for being thus exposed. As a rule then, from the close of the rains and throughout the cold season, no water is given, though after an unusually hot day, the paths of the house are sprinkled in the evening; and of course any orchid naturally affecting equally humid and hot climates, is always kept sufficiently moist to prevent undue flaccidity and consequent loss of foliage, without inducing growth. The hot season commences about the close of February, and then also the majority of Indian orchids begin to bloom. The increasing heat, with a steadily decreasing humidity, now renders artificial watering necessary; though this should be done somewhat sparingly during the flowering period; and this, rather on the floors of the house than on the plants; as the flowers will retain their beauty much longer in a somewhat dry than in a moist atmosphere. Watering over-head should never be permitted until the flowers have naturally faded, nor should any whatever be given, (unless for the reasons previously assigned), until the blossoms have fairly set, as the chances are that the opposite treatment will induce a mere vegetative development, or production of leaf-shoots in place of flowers. With the close of the flowering season, water should be freely supplied every morning and evening, the floors should also be freely watered, and in very hot weather the sides of the house syringed

three times daily; morning, noon, and evening. The rainy season usually extends from the middle of June till about the middle of October. In the early part of the rains, artificial watering may be beneficially continued, should the rain-fall be light and irregular. In August and September, when the greatest humidity usually prevails, this will be rarely necessary, the ordinary rain-fall inducing and sustaining a vigorous growth until October, when a decreasing humidity and temperature gives a check to vegetation and prepares it for the season of rest. By the above treatment, nearly all tropical Indian orchids may be grown well and flowered freely in Lower Bengal; and equally thriving under the same treatment are several of the South American Orchids; as Lœlia, Cattleya, Maxillaria, Lycaste, Burlingtonia, and Stanhopea: species of all of which, with the exception of the last named genus, have flowered in the gardens here.

Orchids, like other plants, can never be kept in a really healthy state if the leaves are allowed to remain dirty; this indeed is a fertile cause of the unhealthiness of plants, under verandah culture in Calcutta and its vicinity. It is most difficult to impress on the generality of native mallees, the necessity for keeping the leaves of plants perfectly clean, and few there are who will not altogether neglect it, unless pretty closely supervised. Orchids are especially liable to suffer from uncleanliness of the leaves, and washing of them cannot be too often performed. The leaves however of orchids being very tender, care must be taken that the skin or cuticle be in no ways injured by the process. To guard against this, use a piece of soft and good sponge; and as soap and water has a much greater cleansing effect than mere water, less sponging will be required by the use of the former than the latter, and the risk of injury to the foliage thereby also decreased. Another danger and a great source of injury to plants wholly under native management arises from watering the foliage under a bright sun, which is thereby burnt and scorched. In

sponging orchids then the operation must be performed in the shade, and the plants retained there until the leaves are perfectly dry; by neglect of this many plants suffer seriously, and have their leaves disfigured with burnt blotches.

The re-potting of orchids—For this operation, no particular season can be recommended, and the cultivator must be chiefly guided by the condition of his plants, changing at any time of the year, when any indication is observed of unhealthy root action. If in good health, the majority however may be safely changed in the early part of the hot season, or with the fading of their flowers, as soon after they begin to make fresh roots and vegetate a-new. The material I have found best suited for epiphytal species under pot culture, is three parts of lumpy charcoal (larger and smaller according to the size and vigour of the plants) to two of partially-burned bricks in the form of koor and kankur; the former being a suitable size for the larger and more vigorous habited sorts, the latter for the smaller and more delicate. Cocoanut fibre and dust are most objectionable, as are also, I believe, the composts of fibrous peat and moss ordinarily used for these plants in European gardens. These materials prove much too retentive of moisture, for general culture in this country, become sour and soddened in the rains; affording harbour for white-ants and other destructive insects, as also a small Lymnæa, or pond-snail, common in the tanks and jheels. This is a most serious pest, eating voraciously the soft developing parts of the roots and the buds. These pond-snails have spiral shells, of a pearly grey colour, varying from one to six lines in length. They must be sharply looked after, especially in the early part of the hot season, when they are most abundant in the tanks, as otherwise from their minuteness they may escape observation until they have greatly damaged the collection. When observed, the plants should be at once turned out of the pots, the roots carefully washed, then re-pot in broken pieces of charcoal and brick only, as above recommended. The per-

fect drainage secured by such materials, while of the very first importance in orchid culture, is also effective in keeping the plants clear of the above molluscs. Thus, I have frequently observed plants in cocoanut fibre and charcoal, swarming with these snails, while others alongside in lumpy charcoal and brick only, and watered from the same tank, harboured few or none. In re-potting, injury to the roots must be carefully guarded against, and those that are found adhering, as they so frequently do to the sides of the pots, should not be detached, but the pots broken and the attached fragments allowed to remain. In such materials as I have recommended shallow pans are preferable to the ordinary form of orchid pots, of which about three fourths is usually allotted to drainage material. The latter may of course be entirely dispensed with, as the free passage of water is effectively secured by the materials in which the plants are grown. The following are the sizes of the orchid pots used in the Botanic Gardens here. The *smallest* is 5 inches deep, by 7 in diameter, and has 5 longitudinal slits along the sides, each 3½ inches long by ¾ of an inch wide. The *second* is 6 inches deep by 8 in diameter, and has 8 transverse and longitudinal slits, 2½ inches long by 1½ broad, and 4 semicircular holes at the base of the sides, each one inch wide. The *third* is 6 inches deep by 10½ in diameter, with 8 transverse and longitudinal slits, about 2½ inches long by 1 in width, and 4 semicircular holes at the base, each 1½ in width. The *fourth* is 8 inches deep by 13½ in diameter, with 8 transverse and longitudinal slits about 3½ inches long by 1¼ wide, and 4 semicircular holes at the base, each 1½ inches wide. The *fifth* is a semicircular pot for suspending, 6 inches deep by 12 in diameter, perforated with four holes in the side and one in the base, each 2 inches in diameter. The pans should be filled to near the rim with pieces of charcoal and brick, on which place the plant and carefully spread the roots; these should next be covered with the above materials and supporting stakes placed around the taller

growing species. When the potting is finished, water must be but sparingly applied, increasing as they begin to make new roots.

Rustic baskets of teak, sissoo, or saul are also much used, and well adapted for most epiphytal species. These should be made in a square form, and one 2 feet on the side need not be more than from 9 to 12 inches deep. Their construction is simple; thus, the wood after being cut into proper lengths, should be first bored at about an inch from the ends. Two lengths of copper wire are now required, the extremities of which should be put through each piece of wood, and fastened round the lowest, while sufficient length should be left above to form a handle for suspending the basket. The plants should be placed in the materials recommended for those in pans with the addition of a thin layer of cocoanut fibre along the bottom and sides of the basket, to prevent the other materials from falling through. Again, there are many species which succeed best on blocks: these should be formed of such wood as saul, teak, or sissoo, which last long and are less liable to the attack of insects, than the mangoe, soondree, and other sorts commonly used. The plants should be fixed to the blocks by fine copper or brass wire, and a little moss, or cocoanut fibre may also be attached to retain moisture until the plant is fully established. During the hot season the more delicate kinds will be greatly benefitted by a thin layer of moss on their roots; and this should be slightly moistened occasionally, so as to prevent undue shrivelling of the plant, and the loss of its leaves, in those species which are not naturally deciduous, even after they are fully established; in the rains the moss should be taken off, and the roots left perfectly bare, and dependent on the natural humidity of the atmosphere. The *Phalænopsi* are very generally grown on blocks, the *Saccolabium ampullaceum, miniatum,* and others are also well suited to this treatment, as are the smaller *Dendrobes, Bolbophyllums, Cirrhopeta-*

lums, many of the *Erias, Cœlogynes, &c., &c.* Those of tall growth or with slender stems may be attached to upright logs of various sizes, and then either fixed directly in the soil in the flower beds, under full exposure to the sun, as with *Renanthera coccinea* and *arachnites, Acampe multiflora, longifolia* and *papillosa, Vanda teres* and others, or fixed with mortar in a flower pot of a suitable size and according to the requirements of the plant attached, either placed in the orchid-house or in the open border. In the first instance the plants require to be fastened to the blocks with copper wire; subsequently they will attach themselves as they grow, and require little further care.

Indigenous terrestrial species may be either grown in shallow pans, with equal parts of vegetable mould, loam, and kankur; or in prepared beds of the same compost and under the shade of bamboos. The other Indian tropical and subtropical species should have a table devoted to them in the orchid-house. They should be planted in well drained pots in a compost of partially decayed leaf mould, and about equal parts of lumpy charcoal and kankur. Not a few of the Bengal terrestrial orchids, as well as those from other parts of India, though affecting in their native wild soils of a very tenacious nature, do not in my experience thrive at all well in such soils, when cultivated in pots. Indeed, I have ever found them to die out, or at least rapidly decrease in vigour, and rarely ever flower; whereas the same kinds grown in a compost of charcoal, and kankur, with a small quantity of vegetable mould, have become well established and rarely fail to afford a profusion of bloom. Their general treatment should be much the same as that recommended above for the epiphytal sorts under pot culture; re-potting when necessary immediately after they have bloomed, or before they commence their season of growth. During their resting period, water should be entirely withheld from all deciduous species, while those of an evergreen habit should only

have enough to prevent any undue shrivelling of the leaves. In their season of growth, nearly all of them require an abundant supply of water; the drainage of the pots being good, as they are generally most impatient to stagnant water at the roots.

Orchids of epiphytic habits being largely dependant on the atmosphere for their sustenance, it is but a corollary of the preceding remarks, to state that of the first importance in their cultivation is a knowledge of the thermometric and hygrometric conditions, under which they thrive best, so that we may thus judiciously control and modify, as we best can, all that may be unfavourable in the climatal conditions of their artificial homes. This for Lower Bengal, (with which alone I have to do here) may be easily effected, as I have shown, by the construction of airy, light-diffusing screens of dry grass, under which for from seven to eight months annually, the orchids may (in so far as atmospheric conditions are concerned) be left to nature; requiring only for the remaining months a more or less liberal supply of water according to the intensity of heat and dryness of the air. A hygrometer, or a dry and wet-bulb thermometer, is thus a most necessary appurtenance of the orchid-house; and most valuable as guides to the successful cultivation of orchids are those tables which show the thermometric and hygrometric conditions under which our tropical and extra-tropical orchids will grow and flourish. With this view I append the following returns for the years 1869 and 1870, in the gardens here:

TABLE A.

The Weekly Mean of Dry and Wet Bulb Thermometers in the Royal Botanical Gardens, Calcutta, for the Year 1869.

TABLE 1. — Thermometers exposed on the North side of a Cocoanut tree.
TABLE 2. — Thermometers in the Orchid-House.
TABLE 3. — Thermometers in the Glass-House.

		Table 1. Sunrise.	Table 1. 12 Noon.	Table 1. Dry and Wet Bulb Ther. at 3 P. M. D.	W.	Diff.	Dryness of Atmos.	Table 2. Sunrise.	Table 2. 12 Noon.	Table 2. Dry and Wet Bulb Ther. at 3 P. M. D.	W.	Diff.	Dryness of Atmos.	Table 3. Sunrise.	Table 3. 12 Noon.	Table 3. Dry and Wet Bulb Ther. at 3 P. M. D.	W.	Diff.	Dryness of Atmos.
Jany.	1— 7th	54·4	77·1	77·5	62·	15·5	35·	55·5	75·1	77·1	64·1	13·	30·	54·	77·5	80·2	74·1	6·1	14·
„	8—14th	53·	76·	82·5	69·1	13·4	30·	53·5	76·6	76·5	64·	12·5	26·	53·6	78·1	78·1	71·	7·1	16·
„	15—21st	55·1	78·4	84·6	68·5	16·1	38·	57·	77·5	81·	64·2	16·8	38·	54·6	79·6	82·2	71·4	10·8	13·
„	22—28th	65·	80·	85·6	70·2	15·4	35·	64·6	79·4	81·2	68·1	13·1	30·	64·	82·	83·4	70·5	12·9	28·
„	29— 4th	66·1	80·1	86·1	72·1	14·	33·	66·2	79·	80·	68·	12·	28·	66·1	80·3	84·3	71·2	13·1	30·
Feby.	5—11th	56·2	74·4	87·5	73·2	14·3	33·	56·3	74·2	82·5	73·1	9·4	21·	55·3	75·4	88·	76·	12·	28·
„	12—18th	63·2	80·5	89·6	74·2	15·4	35·	73·3	79·4	81·1	71·6	9·5	21·	63·2	82·5	89·	78·	11·	26·
„	19—25th	69·2	87·	92·	79·	13·	30·	69·5	86·	85·3	69·3	16·	38·	68·5	82·1	89·2	75·9	13·3	30·

„	26— 4th	71·1	84·5	93·5	80·	13·5	30·	68·2	88·3	86·1	70·2	15·9	35·	70·5	81·	89·4	74·8	14·6	33
March	5—11th	69·5	79·3	93·4	82·2	11·2	26	71·2	77·3	86·3	70·3	16·	38·	70·	76·2	90·1	79·	11·1	26
„	12—18th	74·	90·5	93·6	78·3	15·3	35·	73·	87·4	86·6	70·5	16·1	38·	74·	84·5	90·4	78·8	11·6	26
„	19—25th	70·1	89·5	94·	81·2	12·8	28·	71·5	85·1	87·1	71·1	16·	38·	69·6	82·6	90·3	79·5	10·8	23
„	26— 1st	73·5	93·2	94·2	80·4	13·8	30·	73·5	88·3	87·3	71·2	16·1	38·	72·6	88·4	91·5	81·4	10·1	23
April	2— 8th	78·4	97·2	94·4	78·6	15·8	35·	74·3	92·4	87·5	71·3	16·2	38·	75·2	91·5	91·4	82·2	9·2	21
„	9—15th	79·	92·4	95·3	77·6	17·7	40·	78·2	90·4	90·4	81·3	9·1	21·	78·	89·5	92·	84·	8·	19
„	16—22nd	80·5	97·6	95·2	84·	11·2	26·	80·3	90·1	91·2	82·2	9·	21·	79·2	95·	97·4	88·4	9·	21
„	23—29th	80·	99·	97·1	84·3	12·8	28·	79·5	91·5	93·	85·5	7·5	16·	79·4	97·2	99·5	90·	9·5	21
April	30— 6th	78·5	98·4	97·4	83·5	13·9	30·	78·4	92·4	92·4	83·1	9·3	21·	77·5	93·	94·3	87·	7·3	16
May	7—13th	80·4	98·6	106·1	89·1	17·	39·	79·4	92·6	96·6	86·1	10·5	23·	79·5	95·6	101·	95·	6·	14
„	14—20th	83·2	95·	104·6	84·	20·6	46·	80·6	91·2	96·6	87·4	9·2	21·	81·	94·5	93·	85·	8·	19
„	21—27th	80·	95·6	97·2	86·	11·2	26·	79·4	89·2	92·6	84·3	8·3	19·	78·6	91·3	94·1	86·5	7·6	16
„	28— 3rd	83·1	99·1	102·5	89·3	13·2	30·	82·6	93·1	97·1	86·4	10·7	23·	82·1	96·3	97·1	86·1	11·	26
June	4—10th	79·5	97·	102·2	86·4	15·8	35·	81·4	93·	98·	87·	11·	26·	78·6	89·5	96·	87·3	8·7	19
„	11—17th	83·4	110·6	101·1	89·	12·1	28·	80·5	89·1	98·3	91·1	7·2	16·	82·4	70·1	99·3	91·5	7·8	16

TABLE A.—(*Continued.*)

The Weekly Mean of Dry and Wet Bulb Thermometers in the Royal Botanical Gardens, Calcutta, for the Year 1869.

		TABLE 1. Thermometers exposed on the North side of a Coconut tree.						TABLE 2. Thermometers in the Orchid-House.						TABLE 3. Thermometers in the Glass-House.					
		Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.			
				D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.
June	18—24th	81·4	99·6	99·	87·	12·	28·	80·6	94·5	97·2	88·5	8·7	19·	80·5	96·6	95·4	88·1	7·3	16·
„	25— 1st	80·4	88·4	86·	83·	3·	7·	80·1	87·	86·1	83·5	2·6	5·	80·	84·3	84·2	87·4	6·8	14·
July	2— 8th	81·2	94·	87·4	83·4	4·	9·	81·	87·1	86·6	83·6	3·	7·	81·	84·	86·	83·	3·	7·
„	9—15th	81·	93·	89·5	85·	4·5	9·	80·1	90·	88·5	84·3	4·2	9·	80·4	88·	86·	82·	4·	9·
„	16—22nd	80·	89·6	87·5	82·6	4·9	9·	79·3	86·6	86·1	83·1	3·	7·	79·6	86·	85·3	83·1	2·2	5·
„	23—29th	81·1	93·4	91·3	84·3	7·	16·	77·6	89·	90·4	84·1	6·3	14·	80·	90·2	90·6	84·1	6·5	14·
„	30— 5th	82·5	96·	90·6	84·6	6·	14·	80·	88·6	90·3	84·4	5·9	12·	81·3	89·4	89·2	83·3	5·9	12·
August	6—12th	80·4	93·6	92·1	84·1	8·	19·	79·6	89·1	91·1	84·5	6·6	14·	79·3	87·	89·3	84·	5·3	12·

„	13—19th	82·	94·8	92·3	85·2	7·1	16·	79·2		90·3	83·5	6·8	14·	79·6	90·3	91·5	85·	6·5	14·
„	20—26th	81·6	93·5	90·1	83·5	6·6	14·	80·3	90.	92·5	87·	5·5	12·	80·4	89·3	88·4	84·	4·4	9·
„	27— 2nd	81·2	94·3	93·6	85·4	8·2	19·	80·5	·4	92·1	85·	7·1	16·	80·	89·	91·2	84·4	6·8	14·
Septr.	3— 9th	81·	91·3	89·5	87·	2·5	5·	73·1	86·3	87·6	83·6	4·	9·	80·	87·	87·3	83·4	3·9	7·
„	10—16th	80·1	91·4	85·4	81·5	3·9	7·	78·5		84·6	82·1	2·5	5·	78·4	87·4	86·5	82·5	4·	9·
„	17—23rd	80·2	93·2	92·1	84·6	7·5	16.	78·6		92·	85·3	6·7	14·	78·6	89·	90·1	84·6	5·5	12·
„	24—30th	81·	84·2	86·2	82·6	3·6	7·	77·1		85·6	82·6	3·	7·	78·6	81·5	90·	83·	7·	16·
Octr.	1— 7th	79·	82·	88·4	83·4	5·	12·	69·		86·6	83·1	3·5	7·	75·	81·	91·	84·	7·	16·
„	8—14th	78·6	89·2	89·2	84·2	5·	12·	76·3		87·4	84·4	3·	7·	77·6	85·4	90·	83·3	6·7	14·
„	15—21st	77·	87·5	88·6	83·5	5·1	12·	72·5		89·3	82·	7·3	16·	76·	80·5	85·2	80·	5·2	12·
„	22—28th	72·3	85·5	86·1	78·	8·1	19·	72·5	80·4	84·5	80·4	4·1	9·	71·	82·3	85·	75·6	9·4	21·
„	29— 4th	64·6	82·5	87·3	73·4	13·9	30·	68·	81·1	84·2	71·1	7·1	16·	75·5	80·5	83·3	72·3	11·	26·
Novr.	5—11th	61·5	81·2	84·1	68·3	15·8	35·	66·	79·	79·2	69·1	10·1	23·	61·5	77·1	79·4	71·3	8·1	19·
„	12—18th	67·4	80·5	85·4	70·4	15·	35·	62·	78·3	80·2	71·5	8·7	19·	63·6	78·6	82·3	71·3	11·	26·
„	19—25th	57·2	79·	80·2	71·5	8·7	19·	65·6	77·2	85·4	70·4	15·	35·	62·1	76·2	80·	69·6	10·4	23·
„	26— 2nd	59·	80·	84·3	67·6	16·7	38·	59·5	77·6	81·1	69·6	11·5	26·		74·	81·6	69·3	12·3	28·

TABLE A.—(*Concluded.*)

The Weekly Mean of Dry and Wet Bulb Thermometers in the Royal Botanical Gardens, Calcutta, for the Year 1869.

		TABLE 1. Thermometers exposed on the North side of a Cocoanut tree						TABLE 2. Thermometers in the Orchid-House.						TABLE 3. Thermometers in the Glass-House.					
		Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.			
				D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff	Dryness of Atmos.
Decr.	3— 9th	55·5	77·3	84·3	67·6	16·7	38·	55·5	75·2	81·1	69·6	11·5	26·	57·	72·6	79·3	67·3	12·	28·
,,	10—16th	54·5	76·5	82·5	68·	14·5	33·	57·1	82·5	79·2	68·1	11·1	26·	50·5	72·1	78·2	67·3	10·9	23·
,,	17—23rd	55·4	71·2	82·3	66·	16·3	38·	50·6	73·2	78·4	66·4	12·	28·	57·	82·2	79·4	68·3	11·1	26·
,,	24—30th	54·1	74·4	81·1	67·	14·1	33·	56·1	73·1	79·1	68·5	10·6	23·	55·5	70·	78·2	67·	11·2	26·

TABLE B.

The Monthly Mean of Dry and Wet Bulb Thermometers in the Royal Botanical Gardens, Calcutta, for the Year 1869.

	TABLE 1. Thermometers exposed on the North side of a Cocoanut tree.						TABLE 2. Thermometers in the Orchid House.						TABLE 3. Thermometers in the Glass House.					
	Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.			
			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.
January ...	58·3	78·	83·1	68·	15·1	35·	59·2	77·3	79·1	61·8	15·3	35·	58·2	79·2	81·4	69·3	12·1	28·
February ...	65·1	80·3	90·2	75·	15·2	35·	66·4	81·3	83·	70·2	12·8	28·	64·3	80·1	87·4	75·	12·4	28·
March ...	70·4	85·2	93·5	80·2	13·3	30·	71·1	82·4	86·3	70·3	16·	38·	71·6	82·2	90·1	74·	16·1	38·
April ...	78·1	96·2	95·2	80·4	14·8	33·	77·2	90·5	90·2	79·1	11·1	26·	73·4	92·2	94·2	85·	9·2	21·
May ...	80·5	97.1	101·2	86·2	15·	35·	79·5	91·3	95·	85·3	9·7	21·	79·3	91·2	95·4	87.	8·4	19·
June ...	81·1	98·4	98·4	86·4	12·	28·	81·	91·2	95·1	87·	8·1	19·	80·3	87·2	94·2	88·	6·2	14·
July ...	81·	94·	88·4	83·5	4·9	9·	79·4	88·3	88·	83·5	4·5	9·	67·	87·	86·5	83·5	3·	7·
August ...	81·5	94·	91·1	84·2	6·9	14·	79·5	88·3	92·	85·2	6·8	14·	80·1	89·	89·5	84·	5·5	12·

TABLE B.—(*Concluded.*)

The Weekly Mean of Dry and Wet Bulb Thermometers in the Royal Botanical Gardens, Calcutta, for the Year 1869

TABLE 1. TABLE 2. TABLE 3.

	Thermometers exposed on the North side of a Cocoanut tree.						Thermometers in the Orchid-House.						Thermometers in the Glass-House.					
	Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M,			
			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff	Dryness of Atmos
September ...	80·3	90·4	89·1	84·1	5·	12·	78·4	86·1	88·2	83·3	4·9	9·	79·	86·4	·90·1	83·3	6·8	14·
October ...	74·1	85·1	87·4	80·	7·4	16·	71·3	81·2	86·2	81·2	5·	12·	75·	81·3	86·4	78·9	7·5	16·
November ...	61·4	81·	84·1	70·1	14·	33·	64·1	78·	82·	71·2	10·8	23·	64·	77·1	81·1	70·	11·1	26·
December ...	55·3	77·	82·4	67·1	15·3	35·	59·	76·1	79·4	68·2	11·2	26·	55·3	74·1	78·6	67·4	11·2	26·
Mean Annual Temperature.	72·3	88·	90·4	78·9	11·5	26·	72·2	84·4	87·	77·5	9·5	21·	70·7	84·2	87·11	78·9	8·2	19·

TABLE C.

The Monthly Mean of Dry and Wet Bulb Thermometers in the Royal Botanical Gardens, Calcutta, for the Year 1870.

	TABLE 1. Thermometers exposed on the North side of a Cocoanut-tree.						TABLE 2. Thermometers in the Orchid-House.						TABLE 3. Thermometers in the Glass-House.					
	Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.			
			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.
January ...	53·9	76·5	76·9	61·6	15·3	35·	54·9	73·1	74·7	61·9	12·8	28·	55·8	71·9	67·9	62.	5·9	12·
February ...	60·	84·	85·3	70·9	14·4	33·	60·	80·2	86·8	70·	16·8	38·	60·1	77·	82·9	73·1	9·8	21·
March ...	59·8	93·7	90·9	73·6	17·3	40·	68·	88·	88·	72·	16·	38·	68·9	84·9	85·9	73·9	12·	28·
April ...	72·9	92·3	97·9	78·9	19·	45·	75·	92·9	93·6	76·9	16·7	38·	74·	92·	90·	77·9	12·1	28·
May ...	81·5	96·9	10·1	79·	22·	51·	80·	96·9	94·	76·8	17·2	40·	77·6	91·9	98·	86·9	11·1	26·
June ...	80·9	93·6	92·9	76·4	16·5	38·	86·	95·9	89·9	87·9	2·	5·	79·2	90·2	85·	83·	2·	5·
July ...	85·	93·	88·	85·	3.	7·	79·4	90·	89·5	84·1	5·4	12·	79·	89·	88·9	86·	2·9	5·
August ...	81·	92·	88·9	83·9	5·	12·	79·5	86·6	87·9	86·2	1·7	2·	79·	86·9	86·9	83·	3·9	7·

TABLE C.—(*Concluded.*)

The Weekly Mean of Dry and Wet Bulb Thermometers in the Royal Botanical Gardens, Calcutta, for the Year 1869.

	TABLE 1. Thermometers exposed on the North side of a Cocoanut tree.						TABLE 2. Thermometers in the Orchid-House.						TABLE 3 Thermometers in the Glass-House.					
	Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.				Sunrise.	12 Noon.	Dry and Wet Bulb Ther. at 3 P. M.			
			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.			D.	W.	Diff.	Dryness of Atmos.
September ...	78·4	90·	89·9	81·	8·9	19·	77·4	85·5	86·9	80·4	6·5	14·	78·9	89·	86·	80·3	5·7	12·
October ...	76·	90·	88·	80·	8·	19·	77·5	90·	87·	80·	7·	16·	73·	90·	89·	80·	9·	21·
November ...	73·	80.	86·	74·	12·	28·	69·	77·	84·9	79·	5·9	12·	69·5	77·	80·	74·	6·	14·
December ...	53·	73·5	77·7	62·.	15·7	35·	50·4	70·	72·9	60·9	12·	28·	53·9	70·	76·	63·9	12·1	28·
Mean Annual Temperature.	72·1	87·11	88·7	75·6	131·	30·	71·5	85·6	86·4	76·4	10·	23·	70·9	84·1	84·8	77·	7·8	16·

The minimum temperature in Table I. for the year, was on the morning of the 10th January, *viz.*, 42°, and this was at an elevation of 4 feet above the grass, which in a clear still night not unfrequently indicates a freezing temperature at the grass level. In a clear calm night, I have indeed seen tiny icicles formed on the lawn, while the thermometer at an elevation of 4 feet indicated 45°, so rapidly does the chilling effect of radiation diminish from the grass upwards. The stratum of air surrounding the chilled grass being rapidly reduced to the same temperature, chills it still more, and thus sustains a mutual re-action until the temperature of the grass-environing stratum is reduced very much below the superincumbent strata at a very slight elevation. It is from this, that many of the plants from equable and humid climates suffer so much, when exposed in the cold season, and it is well to remember that the finest screen is sufficient to check the radiation, and thus be the means of saving the plant. I the more especially remark on this here, in its bearings on orchid culture, as many of our orchids will thus be seriously injured if left unscreened, for they never are naturally subjected to any such low degrees of temperature in their more or less elevated habitats on the branches of trees. The maximum temperature was on the 12th May and 12th of June, on both of which it attained 109° at 3 P. M. On the 16th May, the dry and wet-bulb thermometers was in a state of complete saturation, the thermometer indicating 75°. Preceding this (which of course is unusual in May) I may explain that the thermometer, from the 5th to the 15th of the month had ranged between 101° and 109°, and that this ended on the 16th, in a severe gale with heavy and continuous rain, equalising the dry and wet-bulb thermometers, and greatly reducing the temperature. The maximum difference, between the dry and wet bulb thermometers, was on the 14th February, *viz.*, 22°, at a temperature of 76°, so that the actual dryness of the atmosphere was 52°; the dew point

being 24°; though the dryest week was from the 9th to 15th May, the mean as shown by the tables being 40°. We have thus conditions very different from those to which they are subjected in the orchid-houses of Europe, where, according to Dr. Lindley, (I am aware that there are considerable alterations now, but in the absence of any papers, or books to afford exact information, I can but quote a quondam rule,) under the general treatment of orchidaceous plants, the temperature ranged from 78° to 95°, while the hygrometer usually ranged from 15° to 30°. It is thus that so many of the normally deciduous orchids of our Indian forests become evergreen in the orchid-houses of Europe, and far is it from me to deprecate the treatment, so long as the plants fail not in yielding a fair amount of bloom; though from obverse results, I should not in many cases hesitate in doing so. To obviate this however I should rather recommend a decrease in the humidity of the atmosphere than any great decrease of temperature, at least during the day when dry and clear; though this also might beneficially be done by near a score of degrees at night. Growth would thus be checked, and the nutritious matter no longer wholly expended in the production of leaves and shoots, will be stored in the then solidifying or maturing tissues to be ultimately consumed in the formation of flower-buds. Again, an undue stimulus, or the subjection of a plant to a higher and more equably humid temperature than is natural to it, not only arrests floral development, but so deranges the vital processes, and enfeebles the whole system, that from sheer exhaustion, the plant sooner or later (according to the intensity of the stimulus) dies. These results are only too familiar to all horticulturists in this country, who have had experience in the culture of plants from extra-tropical or temperate climes. These may be in high vigour throughout the cold weather, and even in the hot season, though growth is arrested, they will yet live on; but in the rains with a reduced temperature, an atmosphere humid almost to satura-

tion, so stimulates the vegetative processes and enfeebles the organization, that few indeed will survive until the return of the ensuing cold weather. The greatly diminished sunlight of the winter season, in temperate climes is, as I shall subsequently explain, most unfavourable to the successful culture of many kinds of tropical plants in the hot-houses of Europe, though not to be compared with that positively baneful influence of the hot and highly humid seasons, on the plants of temperate latitudes under tropical culture. It has been contended that the amount of heat required by any given plant, for the completion of its different functions, may be determined from the length of time over which they severally extend, and the mean temperature of the period; though evidently no less important is the determining of the concomitant amount of sun-light and atmospheric humidity.

Again, the maximum and minimum monthly temperature on the exposed thermometers for 1870. were respectively in May (96° to 101°), and in January and December, 53° The extremes of the dry and wet-bulb thermometers were in May and July; the maximum of aridity being in the former month, when with a mean temperature of 101° there was a difference of 22° between the dry and moist thermometer, and the real dryness of the atmosphere was thus 51°; this is much more excessive than that of the previous year, as on a single day only a difference of 22° was registered, and the highest monthly mean was 101°. The minimum in July was with a mean temperature of 88°, the difference 3° and the real dryness 7°; very nigh saturation and exceeding the most humid months of the previous years in the proportion of 7° to 12°—see the above tables for September 1869. Again, it will be observed by a reference to *table* 2 for 1869 and 1870, that in the orchid-house the differences between the dry and moist thermometers, are very marked throughout the cold weather, or from November to March, water being then almost entirely withheld. In the hottest season, or

from March to about the end of May, as a rule, the dryness is considerably reduced by watering, though with the dry winds which frequently accompanied the high temperature of May 1870, the mean differences were unusually high. In the glass-house with a much more equally humid atmosphere many of the Indian tropical ferns, and other mountain kinds from temperate altitudes, grow with more or less vigour, while orchids generally become weak and sickly, in its close and over-exciting atmosphere. Forest congeners though many of our ferns and orchids are, they generally affect very different positions therein ; the former growing on the soil, and luxuriating in the forest's deepest shade, whereas we find the orchids haunting the tops of its highest trees or the more exposed branches, accompanied only with deciduous, rhizome-forming and sarmentose ferns, or those of rigid or succulent texture, which thus withstand a desiccating atmosphere and retain a perennial verdure. These fern-forms like the orchids, are generally unsuited to the glass-house, and find a more congenial atmosphere in the orchid-conservatory.

Propagation by division—Is effected in many of the species with considerable facility, while in others it is tedious and difficult. All the elongated, erect, or pendulous stemmed species of Dendrobiums, as also such Epidendrums, as *E. cochleatum* and *E. viviparum*, *Phalænopsis amabilis*, *grandiflora*, *rosea* and others, naturally propagate themselves by buds formed in the axils of their leaves, and in the last named genus on the flower-stalk. The young plants should be allowed to remain until they have formed a few roots, when they may be cut off and planted in small pots. The dwarf growing *Dendrobes* with pseudo bulbs as *D. Jenkinsii*, *D. aggregatum*, &c., the *Bolbophyllums*, and *Cirrhopetalums* with many of the *Cœlogynes* and similarly characterised *Erias* ; the clavate stemmed *Dendrobes* as *D. densiflorum*, *sulcatum*, &c., are increased by division of the plants : so also *Cattleyas*,

Stanhopeas, Cymbidiums, Oncidium, Catasetum, &c., care being taken that each portion detached has not only roots with a few old stems, but also a growing point or young bud. As many of our orchids, however, continue growing year after year, producing only a single series of pseudo bulbs, it is necessary to divide and allow them to remain *in situ* until they have produced young bulbs on the cut portions, when they may be taken out and potted separately. The same means are also adopted to induce species of the above habit to form large radially extending specimens, each portion being then of course allowed to remain in the same pot. By this mode we are said to produce "back breaks" which is thus described in Mr. Williams's excellent little manual on orchid culture. "There are many of our orchids that will keep on growing year after year, and yet produce only one flowering bulb each year; but if the plants are cut, they will produce back breaks, increasing, and soon make fine specimens. This is the way to produce such plants as are seen every year at the London Exhibitions. Some plants are more easy to increase than others. The *Cattleyas* are of this kind. When you have a plant that has back bulbs, if there are about four, cut the plant in two between the bulbs, but not to disturb the plant; let the bulbs keep in the same place. The best time to cut all orchids is during their season of rest, or just as they are beginning to grow. All other orchids that have bulbs should be treated in the same way, if it is desirable to increase them." *Page* 29.

Such distichous-leaved genera as *Vandas, Acampe, Renanthera, Camarotis, Saccolabium, Aerides, Angraecum,* &c., which produce adventitious roots, are increased by a partial cutting off of the top of the stem below the uppermost root, which will induce the production of buds in the lower axils, when the top may be detached, and the same practice repeated with the lower parts as the buds and roots are developed. They are also increased with facility by the

young shoots which many of them produce so freely around the base of the stem. When these are detached, they should be tied to a block of wood, their roots surrounded with moss or cocoanut fibre, and kept in a moist and shady part of the house until they are fully established.

Propagation by seed—Has scarcely as yet been attempted in Bengal, nor is it to be wondered at considering the facility with which full grown plants of most of the species in our collections are got and increased as necessary by simple division. Increase by seed, on the other hand, is slow and precarious, and not likely to be resorted to here, unless with a view to the raising of new or rare species and varieties. That much may be done in this way there can be no doubt. In the habitats of orchids of nearly every country, we find in many species, individuals differing in habit, form, and colour of the flower, from what is regarded as the specific type. Species naturally manifesting such tendencies, lose them not under cultivation; but in general, have them more and more strongly pronounced. We have thus in many of our Indian species, as for example *Dendrobium nobile, densiflorum, Farmeri, Pierardi, formosum* and *fimbriatum*, the *Vanda Roxburghii* and *teres*, *Limatodes*, *&c.*, an abundance of material for hopeful experimentation. "I have seen" remarks Mr. Williams, "at least twenty varieties, or nearly so, of *Cattleya mossiae* in bloom at one time, some had white petals and rich crimson lip, others rose-coloured petals, and yellow lip, all differed more or less from each other; in fact nearly all species of orchids have varieties. Four flowers taken from different plants of *Phalænopsis amabilis* were brought me the other day by a gentleman, and no two of them were exactly alike. The same may be said of *Phalænopsis Schilleriana*, of five plants, which I have seen in bloom, all of them differed in colour, shape of leaf, and flower, all were however handsome. In a wild state varieties appear to be unlimited, crossed, and re-crossed as they doubtless are by insects. *Ly-*

caste Skinneri seems about to have as great a future as the tulip. Already, something like a dozen varieties of colour are known among its exquisitely beautiful flowers, and we can entertain no doubt that it will break into plenty more, especially if recourse is had to hybridising. From deep rose to a skin only less white than the hawthorn, we have a complete set of transitions, and this is a plant conspicuous for its fine broad foliage, and most glorious in its ample floral garments." *The Orchid Grower's Manual, pages*, 30 *to* 33.

Hybridisation—Introduces us to another wide field, by which distinct genera or species are variously blended, and new and interesting forms thereby produced. In so far as the mere manipulation is concerned, no orders in the Vegetable Kingdom present greater facilities than the Orchidaceæ for cross-impregnation, the flowers of nearly all the species being so constructed that fertilisation is absolutely dependent on insect agency, and always easily effected artificially. By way of illustration, I will describe the process in one of our commonest orchids, *viz.*, *Vanda Roxburghii.* As a preliminary to this, however, it may be desirable for those who have no knowledge of botany to give a brief explanation of the parts composing the flowers, and the technical names applied to them. The flowers are of an irregular shape, consisting of a spreading six-parted perianth in two circles; the outer circle *(sepals)* of three pieces, two lateral and one posterior; the inner circle *(petals)* of three pieces, two lateral and similar to the sepals, and one (the *labellum* or *lip*) anterior, shorter than the other parts, serrate, and three-lobed, the central lobe the largest and fleshy. The column is composed of an adherent filament and pistil (together with the anther, rostellum, and stigma) which occupies the centre of the flower, and is thick, short, and obtuse: the anther consists of two lobes, adhering to the apex of the column and terminating below in a viscous disc (the *rostellum*). Each anther-lobe contains a pollen-mass (*pollinium*) or mass of pollen-grains, cohering by internal elastic

threads, and united to the rostellum by a slender stalk, (the *caudicle*). Immediately under the rostellum is the somewhat semicircular stigmatic cavity, the surface of which is thickly coated with viscous matter. Having thus defined the parts of the flower, the process of fertilisation as thus described by Professor Oliver, (in his useful " Lesssons in Elementary Botany") will be easily understood. Take the very fine stem of a grass, or a finely-pointed pencil, and thrust it gently into the spur of a newly-expanded flower, which has not lost its pollen, just as an insect would insert its proboscis, when in search of nectar. It will be found that the pencil does not fail to push against the projecting rostellum, so that the pouch-like membrane of the latter is pressed down, and the pencil comes in contact with the under viscid surface of one or of both of the little glands of the two pollen-masses. On withdrawing the pencil, the pallinia are found adhering firmly to it, for the viscid substance, which bathes the glands, sets hard in a few seconds when exposed. If the pollinia be carefully watched *immediately* after they are withdrawn from the anther, they may be observed to become inclined forwards to such an extent, that if, after the lapse of a minute or two, the pencil be thrust into the nectary or spur of a second flower, the pollinia which adhere to the pencil will strike against the viscid stigmatic surface of the flower, and at least a portion of the pollen-grains will adhere to it and fertilise the ovules of the flower. The viscidity of the stigma is sufficient to overcome the strength of the delicate threads which bind the grains of pollen together.

By the above simple means, the fertilisation is effected, and any given plant may thus be either operated upon by its own pollen, or by the pollen of another variety of the same species, and thus produce a mongrel progeny; or again by that of a distinct species of its own, or in some cases even of distinct genera, and thereby respectively afford a hybrid or a

bi-generic progeny. Dependent as nearly all orchids are on external agents for their fertilisation, there are doubtless many natural hybrids regularly produced, though reflecting on that internecine struggle which rules in feral nature, (race with race, species with species; individually and collectively, this struggle never does relax, the victory ever being to the strongest and fittest, while the weaker go to the wall) it is evident that the chances are greatly against the survival and perpetuation of hybrids: and this perhaps much less from their very general sterility, than from their having inherited a weakened constitution, from the blending of distinct physiological and morphological forms; thus rendering them less able to cope with either of their parental congeners. This is doubtless the reason, why we so rarely find plants of hybrid origin in nature, and well for systematic botany that it is so, as it is evident, "that were hybrids of universal occurrence" as remarked by the Authors of the 'Introductory Essays to the Flora Indica,' "they would have obliterated all traces of species; but exceptional in art, and not proven, if not almost impossible in nature, they cannot be assumed to have produced any appreciable result." On the other hand, crosses between the varieties of a single species are extremely favourable to the production of a vigorous progeny, though the chances are then in favour of the latter reverting to the specific type. Well marked races, however, yield a more or less varied intermediate progeny when crossed, the individual differences of which are much greater than those from good species: results, I may remark, of the more matured characters of species as compared with races. Amongst orchids I can but recall a single case of natural bigeneric hybridism: this is between *Aceras anthropomorpha* and *Orchis galeata*, of which numerous naturally produced hybrids have been described by Dr. Wedell; though as Mr. Darwin remarks, in quoting the above case, "the separation of the former genus is evidently artificial: it is a true orchis, but with a very short nectary." Artificially,

bigeneric hybrids have been produced and given origin to new forms of great beauty, as in those from the *Limatodes rosea* crossed with *Calanthe vestita*—the *Calanthe Veitchei, hybrida,* and of which I extract the following account from the *Gardener's Chronicle for* 1859, *page* 1016. "Of all the beautiful orchids obtained by hybridising, this curious plant stands first. It forms a tuft of flower stems, one foot and-a-half high, loaded with blossoms of the richest rose-colour of different degrees of intensity. Mr. Dominy produced it in the nursery of Messrs. Veitch and Sons of Exeter, by fertilizing *Limatodes rosea,* a rich rose-coloured beautiful Indian orchid, with that variety of the white *Calanthe vestita* which has a deep purple spot at the base of the lip. The result has been most curious, the hybrid although completely intermediate between the two parents, yet shows a greater tendency to its mother than its father. Of the father it has exactly the manner of growth and the peculiar four-boled lip; but it has the rich colour of its mother, and some other peculiarities of her lip along with an entire correspondence in form with her column." Between different species of the genera *Cattleya, Calanthe, Lælia,* and others, hybrids have been raised by a few of the orchid cultivators in Europe, who have also added many new and beautiful varieties to their collections by raising seedlings from variable species, and for which the three last named genera have been highly fertile. Seedling orchids, however, it is necessary to say, are raised with great difficulty, and require much care. "To watch their progress when up, however, is highly interesting—first, the formation of pseudo-bulbs, then their advancement towards flowering, are processes full of pleasure-yielding anxiety. The best place to sow is on the top of an orchid-pot, where the seeds will not get disturbed, let the peat be in a rough state; do not cover the seed, but give a little water with a fine rosed-pot, just to settle it into the peat; some rough blocks of wood on which another plant is growing, afford a capital situation to sow

upon: they should always be kept a little moist, and of such as are sown on pots, in the same way when the plants are strong enough, pot them off separately, or place them on blocks. In potting and taking them up, care must be taken not to break the roots."—*Williams.* For raising orchids in our gardens here, I may recommend the following plans: first, take a partially decayed cocoanut husk, split and tear off a portion of the inner fibrous substance, so as to expose a rough open surface. A flower-pot of a larger diameter than the husk should now be partially filled with kankur, and placed in a saucer of water. Place then the husk on the kankur with the rough inner surface uppermost, after having previously well soaked it in water, then sprinkle the small chaff-like seed upon it, covering all with a bell-glass, and transferring it to the shadiest part of the orchid-house. Care should always be taken to keep the saucer supplied with water, for the double purpose of preventing the entry of wood-lice, ants, &c., and sustaining a humid atmosphere around the seeds, so as to dispense with watering them over head. The rough bark of such trees as mangoe, saul, soondree, &c., and the partially decayed stems of many of the palms as Cocos, Areca, Caryota, and Arenga, afford an excellent *nidus* for orchid seeds: they then require the same treatment as recommended in the use of cocoanut husks. Very favorable conditions for the germination of orchids and other small seeds of epiphytic plants may be afforded by using common fruit-bottles which may be thus prepared: moisten well pieces of charred wood, or of the stems of one or other of the above-named palms, and place them in the bottle, dusting them over with orchid seeds; tie then a piece of light cloth over the mouth of the bottle and place it in a cool and shady part of the orchid-house, watering lightly and regularly with a fine rosed-pot as the material on which the seeds are sown require it. For the different kinds of terrestrial orchids, shallow boxes or pans should be pre-

pared in the following manner: on the bottom, place a layer of potsherds as drainage covering with cocoanut fibre, then add a layer of partially decayed leaves, covering over with charcoal and softly burned brick, broken down into pieces of the size of a bean. After having watered the box and allowed the materials to settle, the orchid seeds should be sprinkled over the surface. No covering material need be added, further than a screen of any light cloth, to sustain a more equably humid atmosphere around the seeds, than could be afforded if left exposed. The box should also be placed in a shady site, and water supplied when necessary from a fine rosed-pot. The seeds of a few of the common Bengal terrestrial orchids, which I have tried when sown as they ripen, take from six weeks to upwards of three months in germinating, and then begin to form tiny bulbous processes which should be left undisturbed in the seed-box, until they have at least completed their second year's growth, when they may be safely transferred to other sites. In the interim, however, care must be taken to protect them from insects; of which there are many kinds partial in the extreme to their tiny bulbs.

The insects most injurious to our orchids here, are the *spotted locust*, the *great cricket*, and the *mole-cricket*, the *common cockroach*, the *mealy-bug*, *scale insects*, *thrips*, and *ants*; and of *molluscs*, we have two or three *land-snails*, and a small *fresh water-snail*; all serious pests if not looked after and destroyed. The spotted locust—*Locusta punctata*—the *Phoringh* of the Bengalees, occasionally causes considerable damage, as does also its ally, that singularly abnormal-formed and forbidding insect, commonly known as the great cricket—*Schizodactyla monstrosa*—though fortunately rare in this part of Bengal. Both feed on the tender leaves and rootlets, and as both are of a large size (from 2 to 3 inches in length, with powerfully constructed mouth, strong horny mandibles and voracious feeders), a single specimen of either will

do a deal of mischief in a single night. Fortunately both of these insects are only occasional visitors to the orchid-house; they should however be carefully looked after and destroyed, as thus only can they be kept in check. The mole-cricket—*Gryllotalpa vulgaris*—the *Oo-chingrah* of the Bengalees, is a most serious pest, though in the Botanic Gardens here, its depredations have been almost entirely confined to out-door plants, and never yet have I observed it in our orchid-houses. I have heard, however, that it frequently affects the orchid-house in other gardens and as might be expected proves a most mischievous visitant. It is of nocturnal habits and noted for its rapidity in burrowing. "The female forms a nest of clay, about as large as a hen's egg, and deposits in it nearly 150 eggs, in the preservation of which it takes the greatest care. Wherever a nest is situated, avenues and entrenchments surround it; there are also numerous winding passages which lead to it; and the whole is environed by a ditch, which presents an impassable barrier to most insects." In the evening it issues from its retreat, and continues producing more or less throughout the night a shrill, jarring note: then also does it commit its depredations, cutting most indiscriminately the stems of any plants which may be near its burrow, and carrying portions of them into it for daily consumption. So actively does it bore, and so numerous are the natural windings of its burrows, that the work of digging them out is tedious in the extreme and not unfrequently futile. By far the best plan to catch them is to flood their burrows with water, which will usually force them to come to the surface when they can be caught and destroyed. Failing this a little cocoanut or linseed oil poured on the top of the water will render it more effective, and as the oil-bearing water reaches and subsides upon them, they must at once come to the surface or die in their burrow: in either case the oil is fatal. I know of no other mode by which these creatures can be kept in

check. The common cockroach—*Blatta Orientalis*—the *Arsola* of the natives of Bengal: this is one of the most serious of insect pests in the orchid-houses of Europe, preying on the tender extremities of the roots and developing flower shoots, and not unfrequently in a single night denuding even a vigorous plant of both. In this country our orchid-houses are too light and open to afford agreeable haunts for these insects, though in the hot season, a few will generally ensconce themselves in the dry loose material of the orchid pot, and thus unseen devour the fleshy roots, or issuing forth at night, gnaw the young flower shoots and buds. When this is observed the plant and pot should be carefully examined as well as those surrounding it until the depredators are caught. Any pot in which they are suspected to harbour should be immersed in water, and they will quickly come to the surface. In the rainy season, I have never observed them in the orchid house; they then fortunately prefer drier haunts. Various mixtures of honey, lard, oil, and arsenic have been suggested for the destruction of these insects and are of course invaluable in the orchid-houses of Europe, which they so numerously affect. In this country however I should hesitate in introducing any such mixtures, in case of the smell proving an attraction for many beyond the bounds of our orchid-houses, and of which some might prefer the orchid shoots to the nostrum prepared for them. The mealy-bugs—*Coccus*—and scale-insects of the genus *Aspidiotus*, require to be constantly looked after and kept under, otherwise we will soon find them overrunning particular plants. Whenever these insects are observed, the leaves and stems of the plants should be at once carefully sponged with water. The mealy-bug may be thus readily checked, the scale insects are more troublesome; though these also may generally be kept down by the use of soft soap, which may be thus used: mix a small quantity with water, rub it over the affected parts, allowing it to remain for a day or so, when it may be washed, and unless

the plant has been seriously infected, a single application will cleanse it. In such a case two or three applications of the following mixture will have the desired effect: to a quart of soft water add two ounces of soft soap, a quarter of an ounce of tobacco, and a dessert spoonful of turpentine; then stir well together, and after forty-eight hours' infusion, strain and bottle for use. The thrip—*Heliothrips adonidium*—and red spider as it is commonly called—*Acarus telarius*—are frequently troublesome on our orchids in the hot season. The thrip is a minute insect about 1½ line long "of a dull deep black, with the point and sometimes the whole abdomen of a rusty colour; the wings are dirty white, the horns and legs yellowish, the extremity of the former black. It attacks plants by piercing the underside of the leaves; and one often sees at the top of the tail globules of blackish fluid, which it soon deposits, and by innumerable spots of this glutinous matter, the pores of the leaves are stopped up, and large portions of the surface become blotched, and the plants thus seriously damaged. The scarlet mite, or as it is commonly called the red spider, belongs to the Acarina, of which the cheese mite—*Acarus domesticus*—is a well known example, and no less in its effects, is the *Sarcoptes scabei*, or Acarus of the Itch, which by multiplying in winding burrows under the skin produces that disgusting disease so prevalent amongst dirty people. The scarlet mite—*Acarus telarius*—is about a line long, and if magnified looks like a crab of an oval form, with the legs so arranged, that two pair are directed forward and two incline backward. It has a few long scattered hairs, and is of a somewhat transparent yellowish-white, more or less inclined to orange, with a blood-coloured dot or spot on either side of the throat; the larger specimens which appear to be females, have a bright chesnut-coloured body, the fore-part being ochry, while the smaller ones have a lead-coloured patch on each side; unlike spiders the throat and body are so united that they form one mass. The female is oviparous and exceedingly prolific; the eggs

hatch in eight days, and it is very remarkable that, when first excluded, the young red spider has only six legs, the third pair being wanting; but this pair is attained when the insect changes its skin. "When very abundant" continues Macintosh, "it has the faculty of spinning a web (in which quantities of their cast-off skins are entangled) and forming for itself a pretty secure retreat: from this circumstance it has obtained the name of *spider*, as well as the specific one *telarius*, from *telas* a weaver. Its mode of operation is to pierce the under side of the leaves, and to imbibe the juice, causing little yellow spots on the upper surface of the leaf at first, which soon spread, and give to the whole leaf an autumnal tint; as their attacks increase, discoloration goes on, until the tree or plant becomes so exhausted that it sheds its leaves, and smaller plants often actually die in consequence." *The Book of the Garden*, Vol. II. *page* 77. The best remedy for the above insects—*thrip* and *red spider*—is to carefully sponge the plants, on which they have made their appearance with clear water, syringing afterwards, and repeating the operations until they are thoroughly cleansed. The mixture recommended above for scale-insects is also used with effect for the latter. Powdered sulphur is also efficacious, and may be readily applied by the sulphurator, or a little may be mixed with water and applied to the leaves; the plants should be well syringed a few days afterwards. As both of the above insects delight in a dry hot atmosphere, their attacks on our orchids is chiefly confined to the cold and hot seasons (throughout which they should be carefully looked after) rarely, never in my experience, remaining on them during the rains. The only other insect pests which I will refer to here are the ants, and these though the last to be noticed, are in many respects the most serious of all the insect pests against which the Indian horticulturist has to contend. Especially destructive are they of small seeds and that of the most varied kinds; fresh and in an advanced

stage of germination, they will assiduously remove them and with astonishing rapidity, make a piece-meal clearance of an extensive sowing. Seeds in flower-pots whether on the conservatories, or exposed; and beds in the garden, are alike subject to their depredations. In the cold and hot seasons, when the orchids are dry, the loose material in which they are grown, affords a favourite haunt for these insects, and is quickly reticulated with galleries connecting their magazines, nurseries, and other apartments; all being constructed with a view to a permanent residence. They do not, as I believe, attack the roots of the orchids, though in the introduction of soil amongst the potting material, they spoil the drainage, and thus injure the plants. Nearly all the species are fond of the sweet secretions of plants, and in extracting those from the flowers, soon give the more delicate a soiled and discoloured appearance. Though the depredations of the ants are thus generally confined to the seeds, in so far as we have to deal with them here, their effects on pot-plants are sufficiently mischievous to render their exclusion desirable. To effect this the native mode—a good and simple one—is to sprinkle powdered turmeric, (*huldee* of the natives, the roots of *Curcuma longa)* on the surface of the haunted pots, and which by a little shaking readily permeates amongst the potting material of the orchids, and the apartments of the ants. To this the ants evince a marked dislike, and a few doses, which may be given without prejudice to the plant, will generally drive them to other encampments. They have also a strong dislike to soot, though this must be used sparingly, and had best be confined to seed-beds, outdoor plants and the like. To pot-plants, ammonia as the Rev. Mr. Wood remarks in his interesting work on "*Our Garden Friends and Foes,*" is a most potent means of destroying insect life, without damaging the vegetation. He recommends "a solution of carbonate of ammonia, the shortest method of preparing which, is to stir the ammonia in boiling

water, adding cold water until it is sufficiently diluted. Care must be taken to perform this operation in the open air, and to keep well to windward of the vessel in which the preparation is being conducted. The fumes that arise from the liquid are so copious and pungent, that they affect the eyes, lungs, and nostrils, and afford a very sufficient reason for their fatal effects upon insects. The ammonia not only exercises, no injurious effect upon the herbage, but is absolutely beneficial to it, giving out some of the most valuable properties of stable-litter."

The following species of *ants* are, I believe, the most troublesome to the horticulturist in Bengal:—The small *red ant* the *khodee peepeelikah* or *khodee peepreh* of the natives.—*Ocodoma providens*—is everywhere abundant, and by far the most destructive of its kind on seeds, eating with apparently little discrimination, sorts of the most varied chemical qualities; though evincing a great partiality for lettuce seeds, and those of nearly every kind of Amarant: the *sags* of the Bengalees. This is so much the case, that not unfrequently, in a few hours after sowing seeds of the above, we will find the surface of the bed completely reticulated with the ridges of these minute creatures, and swarms of them actively removing every visible seed. From time immemorial have ants been regarded as types of industry and economy; and well indeed does this species sustain their reputation. Truly the results effected, and the rapidity of action of these minute creatures are astounding. I may state that in each community there are three distinct kinds of individuals; *viz.*, the *workers*, as those kinds of neuters are called which carry on the general works of the colony, the others being the *soldiers*, distinguished by the large size of their head and mandibles, and whose office is apparently to protect the former in the performance of their various duties; and in addition to these, there are the *perfect male* and *females*. The *workers* are about ⅛ of an inch long, while the *soldiers* are about ¼ of

an inch, with a large head, otherwise similar to the workers, and of a rufous-red colour. 2. *Myrmica diffusa*, is another well known and widely diffused species, remarkable for turning its abdomen almost over its head when running. It feeds on vegetable secretions chiefly, forming its nest on holes in the trunks of trees, or in the roots of orchids, and other epiphytic plants. The workers are about the ⅛ of an inch long, with the head and body of a yellowish-red colour, the abdomen of a dark glossy brown; it is a pugnacious little creature, biting severely, though rarely using its sting. 3. *Ponera processionalis*, the black marching ant, is a widely diffused species, forming underground nests, living in large societies, and usually marching in long columns of from three to four deep: the workers are about ½ an inch long; the colour a shining black, of pugnacious habits, and boldly attacking its assailant with mandibles and sting. 4. *Formica compressa*, the black ant, or *kala kat-peepreh* of the Bengalees, is another widely diffused species, living in large communities, and forming its nest in the soil. It feeds chiefly on vegetable secretions, saccharine substances, &c., they give a sharp bite, but the pain is transitory. In moist weather, after it has been dry and hot, numbers of the males and females may be seen at the mouth of the nest, whence they take wing in vast numbers in the evening. The workers are about ½ an inch long, the body of a shining black, the legs rufous. 5. *Formica smaragdina* the red-weaving ant, or *lal kat-peepreh*, is very common on trees throughout Bengal, as also in other parts of India. The workers are about 4-10th of an inch long, and have an elongated triangular head, large medial eyes, long legs, and colour of an uniform pale rufous colour. Dr. Jerdon thus describes the habits of this ant: "It forms a nest of living leaves, which it draws together without detaching from the branch, and unites with a fine white web; sometimes this web is above a foot in diameter but usually smaller. The

society consists of a vast number of individuals, and in large nests we find many females and males, both with and without their wings at all times of the year. They are very bold and pugnacious, and bite very severely. They live chiefly on vegetable secretions, and are very partial to the flowers and buds of some of the *Loranthi.* They often form a temporary web round the flowers or sometimes round the fruit of various trees; as the *Eugenia malaccensis, Artabotrys odoratissimus,* &c., apparently only for the purpose of feeding undisturbed: they will however also sometimes feed on decaying animal matter. It is said that the web they form is occasionally used for writing on in the North-West Provinces of India, and that the ants are made use of to destroy nests of wasps that may have established themselves in a house. In this case they are said to destroy all the wasps, but become so infuriated that their own indiscriminate attacks are nearly as bad as those of their foes."

The White Ants—*Termes fatalis*—the *rue-pokah, deemuk* or *deeuk* of the natives,—as they are generally called, though belonging to a very distinct family from the *true ants;* and one of which the well known *dragon-flies,* the *stone* and *may-flies,* (favourite baits of trout) are examples. A colony of white-ants is said to be composed of five distinct kinds of individuals. Of these, two are undoubtedly males or females, which at first are exactly similar, and furnished with four nearly equal wings. After impregnation, the abdomen of the female increases vastly in size, from the immense number of eggs contained, which are so numerous, that it is said, as many as 80,000 are sometimes laid by one female in the course of twenty-four hours. The bulk of the community is composed of wingless individuals, supposed to be larvæ, which closely resemble the winged insects, but are destitute of eyes and ocelli; these are the workers, and upon them all the labours of the community devolves. Other wingless

individuals, apparently pupæ, resemble the workers, but have four tubercular wing-cases on the thorax; whilst others distinguished by the large size of their jaws, and which appear to be neuters, are called soldiers: their office apparently being the defence of the community against the assault of enemies. The habitations raised by these diminutive creatures are amongst the most surprising of insect edifices. They are usually built upon the ground, but sometimes amongst the branches of trees, whence they communicate with the ground by a long gallery, twining round the branches and trunk of the tree. Those built on the ground are of various forms, but the most usual shape is an irregular cone. These nests are frequently as much as from ten to twelve feet in height, built of earthy particles, which the workers masticate, and then apply to this purpose. It speedily dries and becomes very hard. The nest is divided internally into numerous chambers and galleries, in one of which the impregnated female or queen is imprisoned, waited upon obsequiously by a numerous train of attendants, whose apartments are in the immediate vicinity of the royal chamber. These attendants carry off the eggs, as soon as laid, into separate chambers or nurseries, when the young produced from them, are tended with the greatest care by the workers.—*Dallas.* The destructive nature of these insects in tropical countries is well known, though certainly greatly exaggerated in so far as living plants are concerned. In the economy of nature, their function is to convert dead vegetable—as also animal—matter into their own living substance, thereby utilising while accelerating its re-conversion into the inorganic materials with which it is built up. That they do this effectively is only too well known, from the indiscriminacy of their attacks, on nearly all dead organic matter. Thus, living in vast communities, the damage they do is incredible: every thing composed of wood, of leather, of paper, of cloth, is subject to their ravages, and even the hardest of our timber-

woods are sooner or later permeated by their galleries. These operations being more especially confined to the interior, it often happens that large logs are reduced to a mere shell and fall to pieces before the mischief has been discovered. There is a prevalent, but certainly a mistaken notion, that they also devour the living parts of plants. Cuttings of sugar-canes, as also those of many of our garden plants, are said to be especially liable to their attacks, and I have thus been induced to bestow considerable attention on their habits. In the sugar-cane cuttings, I find that diseased portions are very quickly attacked by the white-ants, and scooped clearly out to the very surface of the living part: further gnawing then ceases, although the insects remain to sip the exuding juices, and this as frequently happens—when the diseased surface is large—so weakens the cutting that it is unable to afford the necessary nourishment for the young offshoots, until they are self-sustaining, and thus all die and of course become the prey of the white-ant. It is doubtless from examination of the cuttings in these stages only that they have been falsely accredited with their complete destruction. Though I am thus certainly of opinion that the white-ants do not eat the living parts of the cane cutting, I nevertheless believe that they cause a certain amount of damage to them. This they effect by gnawing off the dead and dry parts, thereby exposing a fresh and living surface, from which they continue to draw the thin freely exuding sap, and thus weaken and intensify the disease in a manner which might not have occurred naturally. I thus think that of two similarly and partially diseased canes, of which one is free from, the other attacked by white-ants, the latter will be less able to resist the further inroads of the disease than the former. For the same reasons they are likely to cause injury to cuttings of our ordinary flowering plants; but this can only occur through neglect of the mallee. To attract the white-ant, there must needs be a partially dead cutting

in the pot on which they, in the first instance, ensconce themselves; thence extending their excavations they come in contact with, and perhaps remove the soil from, the cicatrising base of other cuttings, thereby checking mayhap killing them, in thus withdrawing their supply of moisture. In these respects then, I admit that white-ants may, and I believe do, cause mischief to cultivators; but that they really devour the living parts of plants is, I believe, wholly unfounded. As proving the converse, I have had pointed out to me living trees, with their whole stems clay-ensheathed by the white-ants, and the work of destruction apparently rife beneath. Let us denude the trunk, however of its clayey coat, and what see we? simply that the operations are confined to the outer and *dead layers* of the bark: there and there only have the ants eaten, affording us a most excellent proof that the depredations of these insects are confined to the dead parts. Had these too oft perniciously-industrious little creatures been able to find an assimilable food in the living bark, I fancy they would have laboured more economically, extending upwards their superficial covering of clay as their stores of nutriment were exhausted beneath. I thus generally concur with Mr. Firminger, who remarks that "no vermin have a worse reputation for mischief than the white-ant; yet I believe it is almost exclusively for the injury it does within the house that it deserves it. In gardens that white-ants infest, they certainly are exceedingly troublesome for the unsightly mounds of earth they cast up; but all other harm they do, is confined to the consuming of posts and stakes, or any thing made of dead wood. Living plants are altogether secure from their attack. Complaints, it is true are often made of cuttings having been destroyed by them; but I make no doubt but that in all cases the cuttings have died first, and the white-ants have only devoured them afterwards. Moreover sometimes, when a dead plant is taken up, it is found to have its roots preyed upon by these insects, and

the charge is laid against them forthwith of having caused its death, whereas its death had occurred from some other cause before they attacked it."

Various remedial measures have been adopted for the suppression of the white-ant; and of which the following are, I believe, the most efficacious:—A solution of carbonate of ammonia in a sufficiently dilute state (as recommended in a prior paragraph for red ants) is very effective, and should be applied to their harbours through a fine rosed-pot. Dilute lime-water is also very effective. For seed-pots and plants generally under pot-culture infested with white-ants, either of the above remedies may be safely applied. In the gardens and field, I know of no more efficacious applications than gas-lime; it may be sprinkled over the surface of seed-beds, soon after the seeds have been sown; for cuttings of sugar-cane it might be applied to them directly as they are planted. The disagreeable smell of this lime is equally offensive to the red ants, and will drive them away also. In the Journal of the Agricultural and Horticultural Society of India, the following remedies are suggested: "Take a small quantity of arsenic and mix it up with a few ounces of burnt and pulverised ship's bread, oatmeal, flour or ripe plantain mixed with molasses. Place the size of a turkey's egg of this compound on a flat board, covered with a wooden bowl, and put these in several parts of the plantation. The ants will soon take possession of these wooden vessels and the poison will have a general effect; for these ants that die, being always eaten by the others, the whole of the estate will be effectually cleared of white-ants." My experience is far from confirming these results; on the other hand I have never seen any single colony of ants thus decimated; for, though they may not have powers of intercommunication by sound, they certainly have by touch, and their strong preservative instinct, discerning powers, and admirable intelligence, never fail to operate in teaching them to shun that which has proved so

fatal to their comrades. In tropical countries where such myriads of these insects occur, I should always prefer remedies for their suppression, which are alike *offensive* and *destructive*, to those of an *attractive* and *poisonous* character; inasmuch as having only a temporary action, and tending by smell or other qualities to draw colonies from other parts, thereby further endanger the objects of protection. In the same Journal and succeeding the above extract, Mr. J. P Langlois recommends lime as a remedy, and I have also found it very effective. He remarks, "from my experience at Akyab, where white-ants are very numerous and destructive, that manuring the sugar-cane plants with lime, just before the rains set in, and at the beginning of the cold weather, will scare away the white-ants from the immediate vicinity of the plants so manured.—*Vol.* XIV., *p.* 302.

The only other enemies of the orchids to which I need here refer, are a few of the Gasteropod Molluscs,—*snails* and *slugs*—some of which do occasionally prove most troublesome. This, as previously noticed, has been especially the case with a small Lymnea or water-snail, the *ghari* of the natives; myriads of which introduced with the water from our tanks, harboured in the potting material of the orchids, and fed upon the young developing roots. Being only from about 1-6 lines long and rarely appearing on the surface of the pots, it seriously damaged the collection before it was discovered. Various plans were unsuccessfully adopted for their destruction, and I began to fear that we would never get them fairly eradicated, so numerous and minute were they. Fortunately however, as I have previously stated, there were a few sorts of orchids in the collection grown by way of experiment in charcoal and broken bricks only (while those infested with snails grew in charcoal and cocoanut fibre) and as these throve so well, and further kept so entirely free from the molluscous pest, I at once had the whole collection turned out and re-potted in the same materials. This has proved thoroughly effective, and,

though we continue using water from the same tanks, the snails have never again made their appearance and the orchids are generally in a most satisfactory state. There is a second fresh-water mollusc,—*Ampullaria globosa*—with a large, somewhat discid, univalvular shell, of a nearly uniform greyish-brown colour, affecting the sides of tanks, marshes, &c., and not unfrequently making its appearance in the orchid-house during the rains. It is the *shamook* of the natives of Bengal, and by whom it is very generally eaten. A third is a large land-snail—*Achatina pulica*—with a spiral shell longitudinally streaked, with darker and paler shades of a pearly brown colour: it is the *buro-shamook* of the natives. It is interesting to note that this land-snail, now every where abundant in the Botanic Gardens and neighbourhood, was unknown on this side of the Hooghly (though introduced to the Calcutta side about thirty years ago from the Mauritius by Mr. Benson, C. S.) until after the Cyclone of 1864, when the surrounding country was flooded, and the snails thereby introduced from other districts. It is proving a serious pest to agriculturists and horticulturists; eating voraciously herbage of every kind. To the orchid-house, it is a most dangerous visitant, as in a single night it will divest a large plant of the soft extending portions of the roots, the flower shoots and young leaves This, and the preceding species must thus be looked sharply after in the plant houses, and at once destroyed when observed. Their depredations are confined to the rains, and it is a good plan to keep them in check by occasionally sprinkling caustic lime under the tables: for out-door crops infected with these pests, there is no better, simpler, and cheaper remedy than the above, which should be sown broad-cast.

In my subsequent descriptions of the genera and species of orchids now cultivated in Bengal, I shall append notes on the general culture of the different genera, or when necessary, a more particular description of the mode of treatment best

suited to individual species, and I shall now conclude this part with a few remarks on our *Indian orchids* in their *natural habitats*, their *collection* and *modes of transmission*. India, varied as it is, in its physical conformation and climatal conditions, has thus districts characterised for an unsurpassed richness in the vegetal form of orchids, whence we pass more or less abruptly to others in which they become more and more sparse, or are altogether absent: altitudinally and latitudinally, we find in the mountains, the valleys, and the plains, those conditions of warmth and moisture pre-eminently favourable to a high development of the orchid-form, or again others of great or perfect aridity, in which as in that rare, cold, and dry atmosphere, attained in ascending the mountains, no orchid-form can exist. Thus, in vertical as in horizontal space, and within the length and breadth of India, do we find the orchid-flora, as indeed all other floras limited to certain climatal ranges. The orchid regions of India beginning from the South are Ceylon, and many of the forest-clad mountain flanks along the east coast of the Western Peninsula, the Travancore range, the Neilgherries, Kurg, and Nagar Mountains; less rich are those of the Concans, and alike poor in variety and individual number are those of the Deccan. The hill-regions of Central India are also generally poor in species, and in the number of their representatives (even the forest-clad flanks of Parasnath afford only six species of epiphytic orchid; *viz.*, *Pholidota imbricata*, two inconspicuous flowered *Dendrobiums*, a *Vanda*, a *Saccolabium* and an *Aerides*) whence we cross the all but orchidless region of the Upper Gangetic plain to the richly verdant vallies of the Himalayas, the *central* and *eastern* regions of which yield many orchid treasures. From the Western Himalayas including Kumaon on the east, and the Punjab-Himalaya, to Hazara on the west, there is a paucity of species and a lack of individuals, which becomes more and more strongly pronounced on the westward line. "The vegetation," remarks Dr. Hooker "altering with

the climate, presents a very gradual transition from the flora of Nipal to that of the arid Afghan hills. In Eastern Kumaon, the humid valley of the Sarju is filled with dense forests. The curious palm Wallichia oblongifolia has there its western limit, and a pepper, a Pothos, an arborescent Aralia, and a few other plants, indicative of humidity, still linger in its recesses. The influence of climate is however most perceptible on the herbaceous vegetation of the temperate region, and especially on the annual plants which spring up during the rainy season, than on the trees and larger shrubs, which may be presumed to have greater powers of resistance. Hence the Scitaminea, epiphytical, and terrestrial orchideæ, Araceæ, Cyrtandraceæ, Melastomaceæ, and Begoniæ, which form so conspicuous a part of the vegetation of the humid Eastern Himalaya, occur in very small numbers in Kumaon, rapidly diminish to the westward, and scarcely extend beyond the Sutlej."—*Introductory Essay to the Flora Indica, pp.* 191 *and* 193.

In the Central Himalaya or Nepaul, with an increasingly humid and more equable climate, we have a richer representation of orchids. In the tropical valleys, we find such species, as *Dendrobium amœnum, fuscatum, heterocarpum, nobile, primulinum, transparens, &c., Bolbophyllum affine, Careyanum, caudatum, gratum, odoratissimum, &c., Cirrhopetalum Wallichii; Eria alba, carinata, flava, and paniculata; Cœlogyne cristata, fimbriata, fuscescens, longipes, &c.; Vanda cristata, multiflora, Roxburghii and teres; Saccolabium guttatum, curvifolium, macranthum, spicatum,* several species of *Sarcanthus; Aerides affine, odoratum, tæniale; Cymbidium elegans, lancifolium, longifolium,* and many other less popular genera of epiphytic orchids. We have also more or less numerous representations of such terrestrial genera; as *Eulophia, Calanthe, Habenaria, Pogonia, Cyrtosia, Zeuxine, Goodyrea, Georchis, Physurus,* and *Cypripedium.* In greater or less abundance do we find the above named species, and many more of the same or

other genera, more or less numerously represented in the forest-clad valleys and mountain sides of Nepaul; yet all are nearly the same as those we find more profusely represented in Sikkim, and of which they are but the outliers; waning and thinning out quickly in the drier western regions of the country. As illustrative of the impatience of many of these kinds of orchids to a dry climate, we find several of them which there more or less affect evergreen trees only, almost as invariably attached to those of an open and deciduous habit in the more humid vallies of Sikkim. This doubtless is caused by that "somewhat abrupt transition" remarked upon by the authors of the Flora Indica, "from the humid winter of Sikkim to the drought which prevails at that season in the Western Himalaya, as the proximity, not only to the sea, but also to the great mass of snow-clad mountains, which in Sikkim advance to within sixty miles of the plains, is no doubt the cause of that superabundance of moisture in that province. We may therefore" continue the authors "expect to find all the eastern or humid types of the sub-tropical Sikkim floral wanting in the forest between Kathmandu and the Gangetic plain. Accordingly, among palms, *Areca gracilis* and *disticha*, *Licuala* and *Caryota* have disappeared, and one or two *Calami*, *Chamærops*, *Phœnix acaulis*, and *Wallichia* alone occur. With diminished humidity we find increased sun-power, to which the open nature of many of the valleys contributes in no small degree."

The eastern Himalaya, as defined by Drs. Hooker and Thomson, includes Sikkim, Bhotan, and the districts lying to the eastward of the latter as far as the great band of the Brahmaputra, and collectively designated Abor. "The position of Sikkim," remarks the above authors, "opposite to the opening of the Gangetic Valley, between the mountains of Behar on the one hand, and those of Khasia on the other, exposes it to the full force of the monsoon; its rains are therefore heavy and almost uninterrupted, and are accompanied by

dense fogs and a saturated atmosphere. This weather indeed prevails throughout the year as there are frequent winter rains, which are generally accompanied (at an altitude of about 7,000 feet and upwards,) by cold fogs and alternate with frost and snow. March and April are the driest months, and in fine seasons are often bright and clear, but the rains commence in May to continue with but little intermission till October. The rainy winds have free access to the heart of the province and sweep almost without interruption to Kunchinjunga, (28,178 feet), which with the exception of Mount Everest (29,002 feet) is the loftiest mountain and most enormous mass of snow in the world. The snow level is here about 16,000 feet. From the level of the sea to an elevation of 12,000 feet, Sikkim is covered with a dense forest, only interrupted where village clearances," in addition to which there are now extensive tracts under Cinchona and Tea culture, "have bared the slopes for the purposes of cultivation. In the Tropical Zone, large figs abound, with *Terminalia, Vatica, Myrtaceæ, Laurels, &c.*, and the undergrowth consists of Acanthaceæ, Bamboos, several Calami, two dwarf Areca, Wallichia, and Caryota urens; Plantains and tree ferns, as well as Pandanus are common; and, as in all moist tropical countries, ferns, orchids, scitamineæ, and Pothos are extremely abundant. Bhotan, lying to the east of Sikkim, being somewhat shielded from the effects of the southerly monsoon, by the Garrow and Jyntea Hills, which rise on an average to a height of 5,000 feet, and at a distance of about 60 miles south, with the Valley of the Brahmaputra intervening, extend for nearly 250 miles parallel to the Bhotan Himalaya. The moisture-laden wind from the Bay of Bengal, after passing uninterruptedly 200 miles of Sunderbuns and Jheels, reaches the Khasia mountains, strikes upon their abrupt southern face, and discharges from 400 to 600 inches, or nearly from 33 to 50 feet annually, and have thus perhaps no parallel in the world. The winds cooled and well drained

of moisture, pass thence across the valley of the Brahmaputra, there acquiring an increment of heat and humidity, which is not again extracted until they impinge upon the mountains of Bhotan. Even when they reach these, however, little or no condensation occurs under about 4,000 feet, (as they are colder than the mountains under that elevation): though thence upwards on the mountains we have a copious rain-fall. Thus, the vegetation of the Bhotan Himalaya at elevations under 4,000 feet, is of a decidedly dry character, acquiring a considerably more humid type, though alike in profusion and character less more than the neighbouring regions of Sikkim. It is to be remarked, however, that the physical lines thus indicated do not conform to the political boundaries: the western portion of the Bhootan lie beyond the pale of the Khasia Hills, are freely exposed to the southerly monsoons, and have thus a very similar flora to the adjacent portions of Sikkim." "The deep narrow valleys" remark the authors of the Flora Indica, of the great rivers "also carry a tropical vegetation very far into the interior of Bhootan, among lofty mountains capped with almost perpetual snow. These attract to themselves so much of the moisture of the atmosphere, that the bottoms of the valleys are everywhere comparatively dry and bare of forest, which only begins at about 6,000 feet of elevation, except in ravines. The outer ranges too *(except near Sikkim)*, even above this level are only partially wooded, the trees being arranged in clumps, among which are interspersed open grassy glades, which are compared by Griffith to those of Khasia; Oaks and Rhododendrons being extremely abundant."

With these remarks on the physical features, and climatal conditions of the Eastern Himalaya, I shall now consider them in their relations to the indigenous orchid flora: In the Sikkim Terai, we find a mixed forest vegetation of Sissoo, Sal, Dillenias, Terminalia, Butea, Salmalia, Malabarica, &c., trees of a deciduous character predominating and accompanied

more or less with a scrubby undergrowth; all of a dry and stunted character on its plains boundaries. In the outer extremities orchids are scarce and chiefly consist of *Dendrobium Pierardii; Acampe papillosa*, a *few Bolbophyllums; Cirrhopetalum; Sarcanthus* and *Eria; Pholidota imbricata; Vanda Roxburghii; Luisia;* outliers of *Aerides affine* and *odoratum* with occasional plants of *Saccolabium guttatum.* The inner forest zones which skirt the base of the hills, with a large proportion of deciduous trees, supports a richer orchid-flora, though here we rarely find individuals or species abounding on any particular tree but generally very sparingly diffused: isolated plants there are it is true of gigantic dimensions perched upon, or depending from, the higher and usually most exposed branches, rendering the task of collecting most arduous and difficult. The climbing tree after tree, of from 60 to 80 or even 100 and more feet high, following out their ramification, and after all taking from each only, it may be one or two, or as many occasionally as a dozen plants, and thus working until a few coolie loads are collected, wearies out the best collectors, and even the Lepchas, who take so kindly to work of this nature (ascending with agility the highest trees, either by the trunk, or what they like better, the dangling cable-like stems of some of the many gigantic climbers, by which they will fearlessly and quickly ascend the highest trees, much as a sailor would a rope); soon lag and tire of such work and are not slow to make a quiet decampment if likely to be long continued. The difficulties in the collection of orchids in those, as in many other forest tracts, are thus very great, though it is too generally thought that the trunks and branches of such forest trees are everywhere covered with them, and that the collecting part of the work is the least troublesome: a notion I may remark, which none will indulge who have had an hour's collecting of such orchids as *Saccolabium guttatum, Aerides affine* and *odoratum, Dendrobiums Farmeri* and *transparens; Vanda cristata,* &c.,

in the Sikkim Terai. In the river valleys of the interior, orchids become more numerous, as does epiphytic vegetation generally. Of the more handsome and rare species we find *Dendrobiums amœnum, chrysanthum, fuscatum, nobile, ochreatum, primulinum, &c. Phajus albus; Vanda Cathcartii, cristata* and *teres; Phalœnopsis Mannii; Saccolabium ampullaceum, calceolare, &c. Cœlogyne flaccida, ochracea* and *fulvescens, var brunnea,* many kinds of the genera *Bolbophyllum, Cirrohpetalum* and *Eria,* and a host of terrestrial orchids, amongst which is a species probably new—of the curious root-parasitic genus *Erythrorchis.* It ascends trees like the Vanillas by means of stout aerial roots, which form, I believe, parasitic attachments with the bark and wood. It is an extremely rare plant in Sikkim, and I have indeed seen but a single living specimen of it. This was ascending the dead and charred trunk of a large tree in the valley of the Rungjo River, not very distant from its junction with the Teesta: it thus appears to be peculiar in attaching itself to both dead and living tissues. I know nothing however of the nature of its parasitism, though like those with normal root-attachments, it is scaly and leafless, and of an uniform pale-brownish colour. Its singular habit and odd appearance have not escaped the jungle-hunting Lepchas; and in their plant lore, it has ascribed its many virtues, of which not the least valued, is its exorcistic powers, and the immunity of all who have it from the witchery of their many "demons who haunt every rock, grove, and mountain, and are ever actively mischievous." In these valleys I have said that *Vanda Cathcartii* is found: one of the rarest and perhaps most local of all the genus, and of which Lindley said, when originally describing it, that "no more remarkable orchid has been found in Northern India." Some few years ago when in Sikkim, I could only find a very few plants of this species, and nearly all in the valleys of the rivers Rungbee and Rungjo. There were old plants of large size, and growing under dense shade, on trees overhanging the rivers; but vegetating in such

equably hot and humid valleys, they flowered but sparingly, rarely bore seeds, and of those few indeed seemed to find the requisite germinative conditions. I have many a time searched these valleys for seedlings, and only now and again would a solitary specimen greet the eye. This was in 1865 and 66; since which great clearances have been made in the surrounding tracts for Cinchona culture, and this has now—1871—had a marked influence on the natural vegetation spread around: forms of plant-life unsuited to the dense forest, and thus sustaining an unequal struggle with its normal denizens, have now gained by these clearances the ascendancy and driven their quondam suppressors to the deeper and shadier tracts. Singular amongst these are the orchids; plants which are so generally thought to delight in the hottest, *shadiest*, and most humid of habitats; and of the Sikkim tropical species a foremost place would certainly have been *à priori* accorded the Vanda Cathcartii. Less than others, however has it been found limited to such tracts, rapidly is it extending up the sides of the valleys, and promises soon to become one of the commonest of the tropical species. In the drier and more exposed valleys where Vanda Cathcartii was rarely ever found, seedlings by the hundred, may be collected from the trees or picked up on the fallen and partially decayed branches. These plants are naturally of a much less succulent texture, than those growing in the equably humid and shady, valleys, and having also a well-defined period of rest, are thus much better adapted for transmission in close boxes. I have experience of this; and of the more succulent plants which I have thus packed, few ever reached Calcutta alive, whereas in sending those of a thinner and more coriaceous texture, we rarely lose a plant. Mr. Gammie, remarking on the size which single specimens of Vanda Cathcarti attain, says I once found a plant of it at an elevation of 2,000 feet above the sea, completely covering for a height of 10 feet the trunk of a tree 12 feet in circumference. It was

laden with flowers, and neither a spot on its beautiful foliage, nor a square inch of the trunk of the tree, was to be seen; this was by far the finest orchid plant of any species I have ever seen, either there or in England. My disappointment may be imagined when, sometimes afterwards, on taking a friend (the writer as it happens of this paper) to see my splendid plant, I found only the bare trunk of the tree. Some one had found it, and had it carried bodily away, although it must have been a good load for two coolies. In other places I have seen it climbing along trees for 15 or 20 feet, but in a more straggling manner. I was also struck with the impetus these forest clearances had given to many other orchid forms. Trees which as they stood in the jungles supporting but a few isolated patches, now had all the higher parts of their stem and upper branches densely and continuously wreathed with them. This I especially observed on a few isolated trees in the Rungbee Cinchona plantations, and likewise on others at Rishap near the banks of the Rungjo. These when they were spared in the general clearances, bore comparatively few orchids, and when I saw them last in October 1868, the upper portions of their stems and the bare branches were everywhere densely enveloped with many kinds, and of which the *Pholidota imbricata* and *articulata; Eria paniculata* and *excavata,* one or two *Bolbophyllums* and a *Cirrhopetalum, Oberonia iridifolia, Liparis longipes* predominated, and all more or less intermixed. Under favorable conditions we thus see how rapidly orchids do extend; the clearances having only been made about four years previously. Surrounding the trunks of some of those trees also, were gigantic specimens of the *Polypodium—Drynaria coronans,* associated with the *P. Niphobolus adnascens* and *Lingua* with *Davallia chærophylla* and *bullata.* The Drynaria and the two Davallias are all deciduous in the hot season, while the Niphoboli are hygrometric, their leaves becoming closely twisted up in the hot season and expanding

again with the commencement of the rains. The *Vanda cristata* is another scarce and beautiful orchid found in Sikkim. It affects the drier Sal forests of the Teesta, and is generally accompanied with *Saccolabium ampullaceum,* and *guttatum; Aerides affine,* and *Vanda teres;* of which there is also a white-flowered and very rare variety. The Sal trees being here of a gigantic size, and the orchids nearly always fixed on the upper branches, their collection is most difficult and arduous. On the smaller sized trees of these forests and under the shade of the higher, we rarely, if ever, find any of the above orchids; all delight in a full exposure and invite the direct rays of a meridional sun. These are the class of orchids which do well in Lower Bengal: they but require to be planted in an ordinary orchid-pot amongst charcoal and broken potsherds, or as in the case of *Vanda teres* tied to a post of teak or sal, and placed in an exposed position and well drained site; they will require little further attention; though after they have flowered in the hot weather, they will be largely benefitted by an overhead watering every evening. This they get in their native forests, where the rains set in earlier than they do here; throughout the rainy and cold season they require no artificial waterings. If any of the above species are placed in deep shade, they will be found to flower more and more sparingly, the flowers also assuming paler colours; until they will ultimately altogether cease flowering, acquire larger foliage, though of a much less healthly hue, and sooner or later under this excessive vegetative stimulus they will dwindle and die. All the tropical Dendrobes from Sikkim, on the other hand, require the light shade of our grass conservatories; artificial watering being entirely restricted to that part of the hot season intervening between the close of their flowering period and the setting in of the rains. Indeed all tropical Indian Dendrobes thrive well under such treatment: the rest in the cold season denuding them of every leaf, as we find them in their own indigenous

habitats—for I have never yet seen a naturally evergreen Indian species—though they do assume and are thus characterised in the orchid-houses of Europe. The flower buds usually appear in profusion with the increment of heat, towards the close of February and March, and we have always a magnificent display of blossom in April and May. We have thus far confined our remarks to *tropical Sikkim,* but it has also an extensive and no less beautiful orchid-flora in its temperate altitudes. This we enter at an elevation of about 5,000 feet, though considerably above this, we have the tropical forms of Palms and Musas represented: the former in *Calamus montanus,* the *Ruch* of the Lepchas and the *Plectocomia Himalayana,* the *Runool* of the Lepchas; the latter in *Musa Rumphiana, var violacca,* an exceedingly handsome foliaged species; the leaves having longitudinal bands of a bronzy-red, on a bright-green ground. Though varying much in the relative proportion of the two colours, it is always highly ornamental: the fruit is of course full of seeds and unedible when ripe, though used in a cooked state by the Lepchas when immature. "Plectocomia and Musa 'remarks the authors of the Flora Indica' ascend to 7,000 feet and on drier exposures, bamboo and tall grasses form the underwood. Rhododendrons appear below 6,000 feet, at which elevation snow falls occasionally. From 6 to 12,000 feet there is no apparent diminution of the humidity, the air being near saturation during a great part of the year; but the decrease of temperature effects a marked change in the vegetation. Between 6,000 and 8,000 feet, epiphytical orchids are extremely abundant, and they do not entirely disappear till a height of 10,000 feet has been attained."—*Introductory Essay, p.* 180. In the tropical regions *Dendrobium* is specifically the most numerously represented, though in number of individuals far surpassed by some of those inconspicuous flowered *Erias, Liparis, Oberonia* and *Pholidota.* In the temperate regions, on the other hand, *Cœlogyne* is by far the most abundant, specifically and indivi-

dually, while *Dendrobiums* are rare and perhaps with the exception of *D. transparens* and *longicorne,* bearing poor and inconspicuous flowers, as compared with those of their tropical kindred. *Cœlogyne* however fully compensates for the comparative absence of the more handsome flowered *Dendrobes,* and in their season enliven so much these deep forests with an abundance of large and pretty flowers. The real gems of the genus are however those commonly called Pleiones: a group of dwarf Alpine species with large, delicate, and richly coloured flowers, which spring up from the base of their then leafless pseudo-bulbs. They have a vertical range on these mountains of from 6,000 to 10,000 feet. They are thus but ill suited to the climate of Lower Bengal, and can indeed with difficulty be kept alive in the rainy season: pseudo-bulbs introduced while dormant in October and November will, if carefully tended, flower towards the close of the cold or the beginning of the hot season; but though I have succeeded in keeping them for two and even three seasons longer, they never again showed any disposition to flower. They are the Crocuses of their native regions;—flowering in March, April, and May, and carpeting with their bright coloured flowers the mossy surfaces of rocks, or enwreathing the trunks and branches of trees; flowering and thriving alike freely and well, in the deepest shade of those humid forests, and on the dripping moss-clad surface of the sky-opposed rocks. They are in this respect unlike the generality of orchids: it is indeed striking to find them inviting the brightest sun-light, and delighting also in the deepest shade, ascending to the upper and most exposed branches, though in greatest profusion on the lower and most shaded parts of the forest trees. This is much the case also with several of the true *Cœlogynes* indigenous in these forests; and in this respect affording a marked contrast with those of the allied species affecting the tropical valleys of the same mountain, in which all throng upon the highest and most exposed branches, and rarely do we find even a solitary

specimen on the lower and more shady parts—showing very forcibly the unfavourableness of the conditions there afforded; otherwise of the myriads of seeds annually dispersed by the plants above, colonies would, doubtless, spring up on the lower branches from the numberless seeds which settle in a still atmosphere upon them. Mr. Gammie in the letter quoted above, from the Gardener's Chronicle, remarks, "it is true that many of the species are occasionally found in dark, shady places, but they cannot for a moment be compared with plants of the same species found fully exposed to the sun and rain. Abundance of air also appears to be essential to the welfare of the plants, for they are most abundantly found high up on isolated trees, where they catch every breeze, and it is suprising how quickly they sicken and die, when the tree happens to fall among the low jungle beneath, thus placing them beyond the reach of the breeze." High up on the trees of the temperate forests, we have an abundance of beautiful *Cymbidiums;* and of which *C. elegans, giganteum* and *longifolium* are most numerously represented. At elevations of from 5 to 7,000 feet, we find the remarkable parasitic orchid—*Cyrtosia Lindleyana*—so beautifully represented by Dr. Hooker in his "Illustrations of Himalayan Plants." It is a leafless root-parasite, with large amorphous woody tubers, giving off more or less numerous fleshy and horizontal suckers, which form attachments with other, and as I have always found, partially decayed roots, acquire the normal tuberous character and give rise to floral scapes. These are stout, erect and scaly, of a dull reddish-brown colour, and terminating in a large and pretty panicle of golden yellow flowers. On one or two occasions I have had tufts of this plant carefully lifted with its root attachments undisturbed, and sent down to the Botanic Gardens here; but in no case has a single specimen vegetated: for months I have thus kept them, but all ultimately became rotten. Seeds which I got to germinate amongst charcoal and potsherds formed

minute turberoid processes, but though I had them placed under various conditions, none of them survived the rainy season subsequent to their germination. Associated with the *Cyrtosia*, I may also mention a beautiful silvery-foliaged species of *Anœctochilus*, also the *A. Roxburghii*, and a few species of *Goodyera*, *Georchis*, and *Physurus*. The first named is the most abundant, and occasionally forms compact patches of a few square yards in extent, while the others are usually found in isolated specimens: they most abound, and seemingly thrive best in a partially decayed vegetable compost on shady and humid forest slopes, where water however cannot stagnate around their roots.

The tropical forests of Bhotan being generally, as I have stated, of a drier character than those of Sikkim are, as might be expected, less rich in their orchid-flora, and in epiphytic vegetation generally. In the Sal forests as well as those of a more mixed character—*Sissoo, Terminalia, Dillenias, Butea, Salmalia malabarica, Sterculias, Bischofia Javanica, &c., &c.*—we find amongst others the following orchids somewhat sparingly distributed:—*Vanda Roxburghii; Saccolabium guttatum, curvifolium, macranthum* and *spicatum*; *Aerides affine*, a few species of *Bolbophyllums* and *Cirrhopetalums; Dendrobiums Pierardii, fuscatum, densiflorum, Farmeri* and *primulinum; Eria carinata, excavata,* and *paniculata; Liparis* and *Oberonia;* and at elevations of from 3 to 5,000 feet, the lovely *Dendrobiums Falconerii* and *pulchellum* occur, associated with the *D. amœnum, aduncum, sulcatum,* and a species closely allied to, but certainly distinct from *D. Kuhlii.* The rarest or at least the most local and highly valued, as it certainly is one of the most lovely of the orchids now enumerated—*Dendrobium Falconerii*—is sparingly found on deciduous trees, at elevations of from 3 to 5,000 feet, whence plants were introduced to the Botanic Gardens here in 1866. It is found depending from the higher and more exposed branches of these forest

trees, forming densely stalked tufts; the pseudo-bulbs measuring from two to five feet long, slender, and jointed, the joints contracted in the middle or nodose, from one to two inches apart and generally much ramified by the many young plants which break out from the joints of the older stems, and by which of course it may be readily increased. Like *D. pulchellum* and *D. Devonianum* which it resembles in habit, barring the nodulose stem, it is leafless from November to April, and should have only a sufficiency of moisture to prevent its slender stems from shrivelling: towards the end of March the flowers will appear, and water may then be sparingly applied to the roots. The flowers are of great beauty, fully four inches across, borne on solitary peduncles, the sepals of a clear rosy pink colour, and narrower than the petals which are of a rosy-white colour and like the sepals terminating in a broad patch of rich purple: the lip is large and hood-shaped: the ground colour white, with an orangy-yellow disc, a large dark-purple centre, and a broad band of the same colour at the apex; each clearly and well defined. I have never seen the *Dendrobium Falconerii* flower in any orchid-house in Britain and I am thus unable to speak of the relative richness of colours with those flowered under an Indian sun; though, if I may be permitted to judge by Mr. Fitch's representation in the Botanical Magazine, *Tab.* 4,944, (which certainly is a life-like indigenous figure in other respects, excluding the few leaves, which we never do find associated with its flowers in India) I do say that they are greatly deficient in brilliancy and decision: we have no such dilution of colours and blending of shades, each is distinct and well-defined. In the orchid-houses of Britain, heat to any degree can be commanded, but this is but ineffective in the absence of that still intense, though less prolonged sunlight and rare atmosphere of an Indian winter, which ripens and matures the flower shoots in a manner which never can be fully imitated in an orchid-house in Europe. So far as the grow-

ing season is concerned, when heat and a humid atmosphere are alone wanted, I do not doubt that a more vigorous growth may be excited and sustained under artificial conditions in Europe, than when the plants are left to nature's stimuli alone in their own indi- genous habitats. It is doubtless thus, that we find such fine specimens produced so rapidly under artificial conditions, relatively to the time generally required by nature: the results being due to the different disposal of the organising forces; in the former they are largely expended on a mere vegetative multiplication, while under nature we find the stimuli equally directed to that and the development of the floral or re- productive processes. It is thus as I think, while orchid growers in the hot houses of Europe, will excel nature in the production of large and handsome specimens, yet on the other hand, will the plants in their own feral habitats outvie these in the numerical proportion and brilliancy of colouring of the flowers produced. The long nights and the many murky days of a British winter are most unfavourable to the operation of the maturing processes in orchid shoots, and are necessarily opposed to the highest numerical development of flowers. In North Europe those conditions—intensified as they are—must be seriously prejudicial to the orchid culturists, and are by no means compensated for by the clear air, and almost continuous day of uninterrupted sunshine and intense heat, which characterise the summer of those latitudes: this being too short for the completion of the processes of growth and maturation. The most favourable conditions are afforded in the South of Europe, where the sky is so clear and cloudless, the atmosphere so perfectly transparent, the climate warm and dry throughout, with a summer sufficiently hot to permit of the successful outdoor cultivation of various tropical plants. Giving due weight than to the differences between the resting season of Indian orchids in their native forests, and those afforded them in the orchid-houses of Britain during a gloomy winter,

I am no way surprised that orchid-growers find it necessary to afford them more or less shade in the summer season. This however I may be allowed to state the generality of them never do require in their native climes: not even so much as "the partial shade of the trees on the wrong side of the sun, to mitigate the severity of its burning rays":—*see Mr. Anderson's letter on orchid culture in the Gardener's Chronicle for* 1869, *p.* 1040. I can assure Mr. Anderson that as a rule this holds through all the Indian Dendrobes with which I have any acquaintance, and also very generally in *Saccolabium* and *Aerides*, in several of the *Vandas*, in *Acampe*, *Renanthera*, *Camerotis*, *Pholidota*; and generally in *Eria*, *Bolbophyllum*, and *Cirrhopetalum*. I none the less believe however, for the reasons previously assigned, that he has rightly cautioned orchid culturists in Europe against "imitating to a *nicety* all natural conditions in an artificial home." Even when desirable they never can do so in their entirety: humidity of atmosphere or the obverse; heat, shade, the physical relations with the soil, or with other plants, may all be more or less closely imitated artificially; but there yet remains the grand complement in the diminished sun-force, which I repeat never can be compensated for under the above conditions, and failing in this, it will generally, as I am disposed to think, be found good to make some sort of relative modification in the other conditions. I generally concur in the following remarks of Mr. Anderson's: "All exotic orchids, whether epiphytal or terrestrial, when caged up in an artificial structure, and subject to an atmosphere somewhat foreign to their nature, even when best imitated, require more or less shade from a scorching sun. The very plants that will thrive under a variety of circumstances in the countries where they are indigenous, might succumb to similar treatment here. It is well enough to know, indeed such information is most valuable, the range of temperature, the degree of moisture, the exposure, whether shady or open, of all plants under cultivation, but it is not

so desirable for growers to imitate to the very letter the precise habitat. The intense light and heat of a meridian sun must be obviated in every glass-house, but so soon as it begins to wane, and when a number of the species are ripening off their pseudo-bulbs, dispense with your canvass, and clear away all obstruction to the action of diminished light." Over and above all this, however we must not lose sight of the important fact, that from the mere circumstance of a plant being found under certain conditions in nature, it does not by any means follow, that these are the best suited to the plant's development: fixed to a particular spot, it is not theirs to select, but simply to live and struggle as they best can, while an uncompromising nature so orders it, that the strong live and the weak die. Thus; even the fact of our finding certain species exclusively usurping certain habitats, it may be and indeed is, quite possible to place them in other conditions where they will acquire increased vigour. A crowd of illustrations are familiar to all of us: India affords none more striking than the Cacti of a few kinds and the American Aloes—*Agave Americana* and *lurida*—all of which seem to have been introduced to India by the early Portuguese, and are now diffused throughout the length and breadth of the land, flourishing most in the heaviest of its clayey soils, not even objecting to land on which water is stagnant for many months annually, and even then equally as vigorous as those growing on dry sandy soils in arid regions, where they are naturally found. True; growing under these extreme conditions of humidity, they rarely produce seed, but as in the case of the Aloes nearly every flower gives rise to a leaf-bud, and they are thus highly proliferous: an interesting adaptation. To confine myself to orchids however, the Bengal terrestrial species well illustrate the subject. Thus we have here of *Pogonias* and *Habenarias* several species found naturally in damp clayey pasture lands. The pot culture of many of them had been tried in this garden, but always unsuccessfully; they flowered the first season, many of them died out

by the following, and the few survivors rarely flowered again. Thus had they died out, having been transplanted each in the soil in which it naturally grew. A few years ago, I had many bulbs of the different species lifted as they became dormant and planted in flower-pots, filled with pieces of charcoal, potsherds, and some partially decayed leaves. In the following April, they yielded an abundance of flowers, and subsequently a compact surface of healthy foliage. Like their wild congeners they passed into a dormant state, in the cold weather, and are now thoroughly established in the pots, flowering and vegetating freely every season, increasing rapidly, and certainly much more healthy and vigorous to all appearance than their meadow congeners. I have since extended the experiment to many other kinds of terrestrial orchids which I know are usually found in stiff clayey soils, and many of them which I never could succeed with before, are now in a most thriving condition. *Limatodes rosea* and *Calanthi vestita* grow with great vigour and flower profusely when thus treated; whereas in vegetable mould and sand, or in a light loam and the latter, they invariably became sickly and flowered most sparingly. I could add, if necessary, many other illustrations, but these as I think are sufficient to show that the conditions in which plants are found in their own feral habitats are certainly not always the best suited for them under artificial cultivation.

Eastern Bengal, comprehending Assam, the Khasia, Naga, and neighbouring hill ranges; Cachar and Silhet, Tipperah and Chittagong, comprise the richest of all the Indian floras. The atmosphere is generally hot and humid; the rain-fall in certain districts excessive, amounting as at Cherrapoonjee to from 500 to 600 inches annually. In the interior it diminishes considerably, and in Assam; as at Gowhatty, it is reduced to about 80 inches. In Cachar and Silhet the rain-fall is from 200 to 300 inches, the dense fogs prevailing throughout the cold season and succeeded by a moist

spring. Tipperah and Chittagong, owing chiefly to their proximity to the sea have a mild and humid climate with a much less excessive rain-fall than in the adjoining province of Silhet. As in all very humid climates, epiphytic vegetation is generally abundant, and this most markedly in the Khasia Hills, where orchids alone have been estimated to constitute at least one-twelfth of the vegetation, and are the most numerously represented of any of the natural orders of flowering plants. Dr. Hooker remarking on this in his Himalayan Journals says "Orchideæ are, perhaps, the largest natural order in the Khasia, where fully 250 kinds grow, chiefly on trees and rocks, but many are terrestrial, inhabiting damp woods and grassy slopes. I doubt whether in any other parts of the globe the species of orchids outnumber those of any other natural order, or form so large a proportion of the flora." Of these I can but note a very few of the more handsome flowered species, and first, as perhaps the most local (though I certainly will not call the most beautiful) I may note *Vanda cærulea.* "This glorious plant," writes Dr. Lindley, "perhaps the noblest of the Indian race, was called *Vanda cærulea* by Mr. Griffith, who found it among the Khasia Hills, and sent us dried specimens. Its flowers are as large as those of *Vanda teres,* and the foliage is as good as that of *Aerides odoratum.*" "Dr. Hooker subsequently found it near the village of Lernai on the Jyntea Hills. He describes it as occurring in oak woods, on dry grassy hills, at an elevation of from 3,000 to 4,000 feet; the trees are small, gnarled and very sparingly leafy, so that the Vanda which grows on their limbs is fully exposed to the sun, rain, and wind. There is no moss or lichen on the branches with the Vanda, whose roots sprawl over the dry rough bark. The atmosphere is upon the whole humid, and extremely so during the rains; but there is no damp heat, nor stagnation of the air, and at the flowering season the temperature ranges between 60° and 80°, there is much

sunshine, and both air and bark are dry during the day; in July and August, during the rains, the temperature is a little higher than above, but in winter it falls much lower, and hoar-frost forms on the ground." *Vol.* II., *p.* 314. For a few years back we have had many baskets of this orchid from the Jyntea Hills, and have now got it fairly established in our orchid houses. A few plants have also been tied to blocks in exposed positions in the gardens: these, though of slow growth, now flower annually, and do not seem to suffer at all from the exposure. The Dendrobes are also numerously illustrated in those hill-ranges: the most handsome of which are the *D. Devonianum, lituiflorum,* and *lituiflorum, album* (a beautiful and rare variety lately contributed to the gardens here, by Mr. G. Mann), *nobile* in several distinct varieties, *cœrulescens, formosum,* the *var. vera, calceolus, ochreatum, sulcatum, &c., &c.*; of Saccolabiums, we find in the drier forests *S. ampullaceum, guttatum, densiflorum*; *Aerides affine* in variety, *A. odoratum* and *roseum; Cœlogynes* of many kinds, also *Cymbidiums, Bolbophyllum, Cirrhopetalum, Erias, &c., &c.* The terrestrial orchids are also abundantly represented; *Anœctochili* and allied genera, and not unfrequently *Calanthe* and *Phajus* of sorts: one of the most striking of the latter genus, being *P. Wallichi,* which there attains a large size, and throws up magnificent floral racemes. Of *Cypripediums* the following are frequent:—*C. insigne, purpuratum,* and *venustum,* less common is the *C. hirsutissimum. Eulophia* is represented by several species, as are also the genera *Geodorum, Pogonia, Habenaria, &c. Cyrtopera flava* is also found here in great perfection, and in low somewhat marshy lands *Arundina bambusæfolia* is abundant. This is a species well exemplifying the different conditions in which plants are at times found in nature. In Assam, as I have stated, it is often found in marshy places in heavy clayey soils, and then shoots up stout stems of from five to eight feet in height, each terminating in a ramose panicle, the branches

spreading and bearing numerous flowers of a bright rose and purple colour. Again we find it in Sikkim, on dry sandy banks in the valley of the Teesta. It is there exposed to a parching heat for several months annually, and the plants are thus of greatly reduced stature, forming somewhat dense scrubby looking bushes of from two to three feet high. The slender reed-like stems terminating each in a short two or three flowered raceme. In the province of Tipperah, the orchid-flora seems to be comparatively poor and wanting of novelties, and so also is that of Chittagong in so far as it is known. In the immediate neighbourhood of the station, I observed the following species, all of which were scarce:—*Dendrobium Pierardii; Aporum anceps; Pholidota imbricata; Luisia brachystachys and Acampe papillosa.* In addition to most of the above, I collected on the littoral hill range near Seetakoond (and of which the highest hill rises to a height of 1,136 feet, and bears the same name):—*Dendrobium aggregatum; Vanda Roxburghii* and *teres; Cymbidium alœfiolium* and *alatum; Acampe longifolia; Saccolabium guttatum; Camarotis purpurea; Micropera pallida; Aerides odoratum;* and, of terrestrial species *Arundina chinensis; Geodorum dilatatum* and *candidum;* a new species of *Pogonia* with large, plicate foliage, broadly zoned with a rich bronzy colour on a green ground. These were chiefly found on the east slope of Seetakoond Hill, it being much more densely wooded and more humid than the west slope, which is steep, often precipitous, presenting as Dr. Hooker remarks "the appearance of a sea-worn cliff to the Bay of Bengal."

Burmah, the Tenasserim Provinces, and the Andaman Islands include several rich orchid districts, which have of late years afforded many new species of exceeding beauty. A considerable number of these have been discovered and introduced to our gardens by Col. Benson, from whose interesting letters on the Burmese orchids, I make the following extracts on the climate, &c., in which they are found: "The

rain-fall at Moulmein not unfrequently exceeds 220 inches, between April and November, and I have, within my experience, known 6 inches, or one-fifth of the yearly rain-fall of England, to fall in 12 hours. At Rangoon the rain-fall is somewhat less, not, however, of such a difference as to exclude the growth of the same plants, with few exceptions as are found in the vicinity of Moulmein. The flora of these districts is nearly identical. Moulmein, from its proximity to the sea, is refreshed in the hot weather by cooling moist sea breezes, and therefore is not subject to the same amount of dry heat in summer, as Rangoon, which is more inland. There are two plants found at Moulmein, never seen elsewhere by me in Burmah, and these two are Phalœnopsis Lowii, and Cypripedium concolor. Phalœnopsis Lowii is unquestionably a very rare plant, as difficult, I should think, to grow as it is to find. It is found on the lime-stone rock near Moulmein, approached from Moulmein, either by the Salween or Gyne Rivers. These rocks, vast masses of carbonate of lime, rise out of the plain abruptly to the height of above 2,000 feet; consequently the rain clouds are attracted thereto, giving the mountains and their vicinity an extra degree of moisture as compared with more open plains. On the same rock, but in a different position and under peculiar conditions of growth, is found Cypripedium concolor. Phalœnopsis Lowii is seated on the rock, receiving not only the direct downfall of rain, but also the drainage from the mountains above. Cypripedium concolor is found not only in shady places on the lime-stone rocks, but at this spot, and also up the Attaran River, growing on a stalactite formed by the filtration of water through an arched cavity in the rock. I would mention that Adiantum Parishii may also be found here in abundance, as well as at or near the top of the Thakabui Mountains, its only supposed place of growth," see *Hooker's Species Filicum, Vol. II., p.* 238.

Cypripedium concolor I may state grows with great

vigour, and flowers freely in the orchid-houses in the Botanic Gardens here: more delicate though in fair health and flowering freely have we also *Phalænopsis Parishii.*

"These mountains" continues Col. Benson, "at the latter end of the rains are objects of great attraction to botanists. They are at this season covered with a luxuriance of vegetation. Ferns, mosses, orchids, &c., crowd on the rocks and trees; Platycerium Wallichii of gigantic size, with its pendent fertile fronds, and Drynaria quercifolia of proportionate dimensions may be seen. Again, visit these parts after the rains have ceased, and the sun will have been playing his part, doing what is termed in England a little scorching."

"Between November and March, vast changes have taken place: the pendent fronds of Platycerium Wallichii have shrivelled to nothing, the upper frond dried as a dead leaf. Phalœnopsis Lowii, waving in all its splendour, in full flower and leaf in October, cannot be seen; the roots only left and attached to the rock, which in exposed places, from the absorbed heat, would be hardly bearable to the hand. The stalactite has ceased dropping; in fact all nature seems drooping and fading from excessive heat."

"Dendrobium fimbriatum, D. Farmeri, D. barbatulum, D. nodatum, D. formosum, D. Dalhousianum, D. albo-sanguineum, D. moschatum, D. chrysotoxum, D. aggregatum, Saccolabium curvifolium, S. Blumei, Aerides Lobbii, A. rosea, Vanda gigantea—each may be said to have a range of distribution from latitude 14° N. to 16°. Amongst these I will also include Dendrobium lasioglossum and Saccolabium ampullaceum. Yet they are found in a somewhat drier locality, nearer Rangoon than some of the above. I will also mention that I have found D. albo-sanguineum and Dalhousianum, together with D. Parishii and chrysotoxum, extending at intervals from Moulmein to Prome and across the Arracan Mountains to Tongoup. It is difficult to understand why some orchids should thrive under such varying climatic

differences, whilst, on the other hand, others are circumscribed in their particular localities; however as a general rule, I think we may come to the safe conclusion, that all orchids require a decided season of rest.

"The rains commence about the middle or end of April, increasing in intensity until June, from which month, to the end of September, they are at their maximum, gradually subsiding until the end of October or beginning of November, of course the monsoon decreases as you recede from the Coast line inland."

Referring to the Arracan Hills and the orchids they afford, Colonel Benson continues "as I have mentioned, Vanda Bensoni and Saccolabium giganteum are found in the plains in the drier climate of Prome and its vicinity; but when you commence ascending the Arracan Mountain, to which I have already referred, all trace of S. giganteum is lost. The ascent of these mountains begins at a place called Neeoun Kidouk, about (30) thirty miles from Prome due west; and the highest point reached in crossing through this mountain pass, leading to Tongoup, is about 2,500 to 3000 feet. At the height of about 2,500 feet, the following orchids are found:—Dendrobium crystalinum, D. chrysotoxum, Thunia Bensonœ, Pleione Wallichii, Vanda Denisoniana, D. binoculare and D. crassinode; and at a lower elevation, say 1,500 feet Dendrobium Bensoniæ and Vanda cærulescens. The first time I visited these hills was in the beginning of February. The trees had dropped their leaves, the jungle grass was burnt up even to the elevation of 1,500 feet. The hills were bare. The stems of the leafless trees were charred and scorched, giving the whole country thereabouts a burnt, black, desolate appearance. Here the heat was almost insupportable, and I do think I shall not be exaggerating in stating that the thermometer could not have been less than 120°. in the shade at this season; yet this is the spot selected by Vanda cærulescens, Dendrobium Bensoniæ, and other orchids. It is

not until we get to a higher elevation that we come across Dendrobium crassinode, D. crystallinum, Vanda Denisoniana, D. binoculare, D. Farmeri (yellow variety,) &c. The three last named plants prefer more shady places to D. crystallinum, and D. crassinode."

On the Andaman Islands, orchids are largely confined to the Mangrove tracts which fringe the shore lines, and here the most abundant according to Mr. Kurz, (who has drawn out a report on the vegetation of those Islands), are the *Eria Kurzii, Pholidota imbricata, Dendrobium crumenatum ; Oxystophylum, Cleisostoma, Cirrhopetalum Andersonii,* and *Bolbophyllums.* Of the genus Vanda, four species are given by Mr. Kurz, three of which are supposed to be new, the fourth *V. teres* which is found both in the Mangrove jungles and the interior of the Islands. These four Vandas ; the *Saccolabium guttatum ; Dendrobium crumenatum,* and *D. cretaceum,* the only true Dendrobes, I believe, found on the Islands (no others of the many beautiful species found on the opposite mainland, being there represented) *Cirrhopetalum Andersoni ; Eria Kurzii* and *Jenkinsii* are the only species, so far as yet known, which have any special value from a florist's point of view; the others having small, and inconspicuous flowers are only suited for cultivation in Botanic Gardens or general collections.

The Malayan Peninsula affords the last of the Indian orchid-floras, which I will notice here. It extends from the southern extremity of Tenasserim, to within about two degrees of the equator. It is a long, narrow strip of land varying from about 100 to 150 miles in breadth, contracting at its southern extremity to about 50 miles. A chain of hills extends through its whole length, generally of low altitude, though occasionally rising in isolated peaks, and attaining in Mount Ophir, near Malacca—which is the highest—an altitude of 4,320 feet; Kedah Peak is 3,897, and the Island of Penang off the West Coast of the Peninsula, with an area of about

160 square miles has a central range of hills, of which the highest peak is 2,922 feet. The climate of the peninsula is mild and equable, subject to the regular monsoon winds, which are the South-West, while the sun is in the northern hemisphere, and the North-east, while the sun is in the southern hemisphere. Both are rainy, though the North-east is the more so, and the rainiest season is from November to January, though even then it is never excessive.

"In the equable and humid climate of Malaya, 'remarks the authors of the Flora Indica,' we have a vegetation almost identical with that of Java. The surface, except where clearances have been made by man, is covered with a shady forest, rendered almost impenetrable by a dense jungle of rattan *(Calamus)*, a genus which attains its maximum development in the Malayan region. Erect palms are also very numerous; chiefly of the genera *Areca*, *Arenga*, *Licuala*, *Cocos*, *Corypha*, and *Sagus*. On the coast, Nipa covers immense tracts. Orchids, terrestrial as well as epiphytical, *Scitamineæ*, *Araceæ*, and ferns, abound in forests, which consist chiefly of gigantic *Terebinthaceæ*, *Sapindaceæ*, *Meliaceæ*, *Garciniaceæ*, *Dipterocarpeæ*, *Ternstrœmiaceæ*, *Leguminosæ*, *Myrtaceæ*, *Combretaceæ*, *Lauraceæ*, oaks and figs. *Dilleniaceæ*, nutmegs, *Sapotaceæ*, including *Isonandra Gutta* (the gutta-percha plant), and *Anonaceæ*, form an unusually large proportion of the flora. *Podocarpus*, *Dacrydium*, and *Dammara* are the only conifers, but there are several species of *Gnetum* and of *Cycas*. On the higher hills a few species of *Gaultheria*, *Rhododendron Vaccinia*, and other plants of the sub-temperate zone, indicate the commencement of that rich and varied flora which covers the middle and upper parts of the mountains of Java, and the Khasia, and is also found in the temperate Sikkim Himalaya."

The orchid-flora affords many new and interesting species one of which the *Grammatophyllum speciosum*, is the most gigantic representative of the order, and which from its vigour of growth and large and showy flowers has been

called the "king of orchids," even as its forest congeners Phalœnopsi have been called the "queen of orchids," for the exceeding beauty of their chaste and delicate flowers. The "*Letter plant*," as *Grammatophyllum speciosum* is popularly called, is a terrestrial orchid affecting the forest marshes of the peninsula, and there throwing up stems varying in size from five to ten, or even more feet high by three to five inches in circumference. The leaves are strap-shaped often upwards of two feet in length by an inch and-a-half in breadth, and closely set in a two-ranked manner. The flower-scape rises from the base of the stem, is from two to six feet long, supporting numerous bright yellow flowers, speckled and blotched with deep purple, each above six inches in diameter. *Bromheadia palustris* is another interesting and curious terrestrial orchid found in the Malayan Peninsula, and occasionally found in collections here under the older name of *Grammatophyllum Finlaysonianum.* In habit it has no small resemblance to the *Epidendrum ellipticum,* so common in our gardens, and like it has the leaves on the upper part of the stem reduced to close-fitting distant sheathes, terminating in a rigid, zigzag flower spike; the flowers are about an inch across, the sepals and petals white, the lip of a yellow and straw colour, the lateral lobes tipped with violet. Besides these there are many other terrestrial orchids of the genera *Calanthe, Phajus, Geodorum, Georchis, Goodyera, Eulophia* and *Cypripedium barbatum, purpuratum* and *hursutissimum.* Of epiphytal orchids we find the curious and pretty little *Cirrhopetalum caudatum* with sepals prolonged into slender spirally convolute tails, and several other interesting species of this genus. *Oxysepala ovalifolia* is also a Malacca plant, interesting as Dr. Wight remarks "from its so clearly explaining the structure of the column of orchideous plants, through the separation of the stamen from the stigma. In most orchids these two sexual organs are united into a single body, with the variously formed anther lying in the top. Here the two sets of organs are respectively free and

distinct, as in other bi-sexual flowers." *Dendrobiums* so common in the Tenasserim Provinces and Burmah, are represented by a very few species in the peninsula; *Cœlogyne* is also rare, though there are a few handsome species not uncommon; and equally rare are the *Vandas, Aerides,* and *Saccolabiums;* the majority of the representatives of which affect less humid and equable climates. While none of the large genera of Indian orchids are at all numerously represented by species in the Malayan Peninsula, there are few of them altogether absent, and of these there are generally no lack of individuals. Nepenthi, or Pitcher-plants of many kinds are abundant in the moist forests, and so are some curious genera of *Aristolochia*—Birthworts—and of fruits we find the Mangosteen, the Durian, the Rambutan, and the Langseh, which cannot be grown with any great success in other parts of India. The peculiarities of climate are further shown, as Dr. Hooker has remarked, "by the remarkable fact that the teak, which abounds in some parts of Java, and in the northern districts of Tenasserim, is not known to inhabit the Malayan Peninsula."

I have included in the above sketch all the richer of the Indian orchid regions, and noted the climatal conditions and other physical relations of growth, as showing those most favorable to a high degree of development, or conducing to the most numerous natural representation of the orchid-form. I shall now conclude this paper with a few remarks, on the collecting of orchids in their native haunts, their packing, and subsequent treatment, as also that of newly imported kinds: The best time for collecting orchids is the cold season, when all are truly dormant: the hot is less favourable for the many kinds which then begin to push out their flower-shoots, though by far the least favourable is the rainy season, when all are in full vegetative activity. This is especially the case, if the orchids are gathered with a view to exportation, or even distant inland transport: for short

distances, if carefully collected and packed in the open hill-baskets, they may be even then safely enough conveyed. Many valuable collections have been thus sent to the Botanic Gardens here, during the rainy season, from Sikkim, the Khasia Hills, the Tenasserim Provinces, and the Malayan Peninsula. Too much care however cannot be taken to avoid bruising the tender foliage, with which they are then clothed; as this induces rot, which soon extends and seriously injures, or entirely destroys, the more delicate sorts. It is thus at all times best to collect, if possible, in the cold weather, and if the plants are in good health and full grown, the satisfaction of seeing them flower shortly after their introduction will generally be afforded; this they can never do so well when the flower shoots are already partially developed, ere they have been taken from their habitats, unless much extra care is bestowed on them. For inland transit, I at all times for the generality of orchids prefer the stout elongated baskets in common use with the natives; and especially those of the hill districts where the orchids are abundant. In the cold and hot weather, I give preference to the closely wrought kinds, while in the rains those with open meshes are preferable. Of course in thus conveying them as by ordinary bullock wagons from districts unconnected by sea or railways, it will be occasionally necessary to throw an awning over them as a shelter from strong sunshine. In transmitting them in close boxes, they should first be carefully dried, and all packed tightly, so as to prevent their moving and rubbing against each other in the box, which should also be perforated, so as to admit of some little circulation of air. Phalœnopsi, and other delicate kinds, generally found in equable and humid climates, should as a rule be transmitted in closed boxes, or what is better Ward's cases. In sending them in closed boxes, they should be well dried without actually causing the shrivelling of the leaves, and if the roots have been detached from the branches, they should be rolled in

dry moss, and all carefully spread out in tiers with intervening layers of perfectly dry and soft grass; pressing all somewhat firmly to prevent their shaking and bruising each other in the transit. On their arrival at their destination they should be at once unpacked, fixed on blocks of sissoo, teak, &c., according to the size of the plant, and either placed in orchid-pots among the materials previously recommended, or grown permanently on the blocks alone as may be best suited to the particular species.

In packing orchids for exportation to Europe or other distant countries much more care is necessary than that recommended above. Especially necessary is it that the plant, which it is purposed sending should be truly dormant, and perfectly dried, if intended for a closed box. These points being seen to, the individual plants should have their roots covered with dry moss, or failing this, soft shavings or dry doob-grass. Let a thin layer then of dry *kash grass* be first fixed with slender battens on the bottom of the box, and place on this one or more tiers of orchids according to the size of the plants. A batten must then be tightly fixed over the roots, to prevent their moving and bruising each other in the journey, and another, less firmly towards the extremities of the shoots. Large plants with long shoots; or leaves such as many of the Dendrobes, Erias, Cymbidiums, &c., should be packed in long boxes which will allow of their shoots being laid out at full length, though again such sorts, as *D. macrophyllum, Pierardii, transparens,* and others which have more or less slender flexible shoots, from five to six or more feet in length may have their tops curved round, so as to reduce their length. In either case however the roots should always be confined to the same end of the box; all placed tier above tier, with intervening battens, firmly fixing all. In orchids of smaller size —such as many of the Dendrobes, the Cœlogynes, Bolbophyllums, Cirrhopetalum, and the like—they should be similarly

packed in tiers in two ranks, with their roots at the opposite ends of the box: the latter should be sufficiently long to leave an open space in the centre between the tops of their leaves or stems, not forgetting to have a slender batten lightly fixed over the tops of each tier, to prevent any undue friction. The many kinds of Vandas, as *V. Roxburghii, Bensoni, teres, cristata, cærulea, densiflora*; *Aerides* as *A. affine, crispum, cærulescens, maculosum, cylindricum,* and also *odoratum,* (as found in the Sal forests); Saccolabiums as *S. ampullaceum guttatum, Blumei, miniatum, giganteum*; Acampe; Renanthera, and indeed all orchids affecting districts with well-defined seasons of rest and growth, may be safely exported in a dormant state, and as above recommended in closed boxes. On the other hand, those kinds which inhabit equable and humid climates and have thus no well-defined periods of rest, must be differently treated. For such sorts, by far the best mode is to have the smaller sized plants established on flat pieces of wood previous to their being packed: the box should be divided by slips into compartments of various width, according to the size of the plants, so as to keep the plants on either side free from each other, and all may be arranged either in a vertical or horizontal position. On either side of the slip-boards, the plants, established as recommended, should be securely nailed: after which to prevent friction of the leaves and shoots, secure them longitudinally and transversely by bands of any soft material, when each board may be returned and fixed in its slide. A large number of orchids may be thus safely stored in an ordinary deal box, constructed of planks, of say from three-quarter, to one inch in thickness. By this mode of packing, the following among other of our Indian orchids may be safely exported:—*Vanda Cathcartii, Denisoniana; gigantea*; *Aerides odoratum (from moist forest habitats) virens, nobile,* various *Erias, Cirrhopetalum* and *Cœlogynes*, *Phalænopsi, &c., &c.* Again for *Cypripediums, Anæctochili, Physurus, Georchis, Geodycras,* and the like, all the less de-

licate sorts should be spread out in an airy verandah until they are quite free from extraneous moisture. They should then be arranged in small bundles, or individual plants when of any size, and have their roots tied up in dry moss: they should then be allowed to remain in the shade in any dry and airy place for a few days longer, when they may be thus finally packed: divide the bottom of the box into small compartments, with sides of from two to five inches or so high, according to the size of the plants: into each compartment, fix a single bundle or plant, as the case may be, filling up any vacancies in the sides with dry moss, and allowing the leaves or stems to project: slips of bamboo rolled in cotton should now be nailed over the tops of the compartments, so as to prevent the plants sliding out, in case of the box being turned upside down. A few inches above the foliage of this lowest tier of plants, fix a similarly prepared shelf, and so on until the box is filled, when all may be tightly closed up. For many of the more delicate Ancætochili and allied genera, it is first necessary to have them established in small flower-pots, or failing these, the culms of bamboos cut into suitable lengths, and all packed in Wardian cases for exportation.

The best time for exporting orchids to Europe is the cold season, when they are generally in a dormant state : for the central and northern parts however they should not as a rule be despatched before the beginning or middle of March. Thus despatched by steam-ship *via* the Suez Canal, they are not likely to be injured by *frost* on their arrival; as they are very apt to be, if sent earlier: a slight frost is quite sufficient, it must be remembered, to destroy the contents of a whole case. In importing the South American, and other orchids from Europe, it should be so arranged that they arrive here from about the end of the hot, until about the middle of the rainy season; so that they may be fairly established before the cold weather sets in. They should be at once

fixed on blocks of wood, or planted in flower-pots, rather sparingly watered, and kept in a shady verandah, suspended over a gumlah or trough of water, until the new roots begin to protrude and growth commences; when they may be transferred to the orchid-house, and there treated in the manner above recommended for their congeners.

Remarks on the pruning of Tea, by George King, M. B., F. L. S., *late Deputy Conservator of Forests, Kumaon.*

Although it is about a quarter of a century since its cultivation was begun in the North-West Provinces of India, only a few years have elapsed since tea first began to be seriously looked upon as a garden crop, and to have the commonest principles of horticulture practically applied to it. The idea that guided tea planters in these provinces for many years, appears to have been that tea is a kind of forest crop, on which high cultivation would be thrown away, and in fact that hoeing and manuring were likely chiefly to stimulate the growth of the rank grass and weeds that still disputed possession of the soil (usually only too successfully) with the Chinese exotic, to the success of which they were looking for the realization of their fortunes! In consequence of their attachment to such ideas, they did not consider a practical acquaintance with farming or gardening as of prime importance in the manager of a plantation. Great energy indeed was often displayed in planting out tea bushes, but none whatever in caring for them afterwards. *Laissez faire* was really the motto, and the practice was thankfully to collect what seed and leaves the bushes might yield, and by the aid of a Chinaman, (who might or might not have had anything to do with tea-making in his native country) to convert the latter into as good tea as possible. Among the ordinary operations of gardening in respect of which tea had been, until very

lately, quite neglected is that of *pruning,* and on the *rationale* and practice of this I now venture to submit a few remarks.

The tea gardens of the North-West Provinces are located either in Dehra Dhoon, a district lying at the base of the Himalayas on a plain about 2,000 or 2,200 feet above the level of the sea, or on the lower and outer ranges of the Himalayas in the provinces of Gurhwal and Kumaon, at elevations varying from probably 4,000 to 7,000 feet.* With a few exceptions not worthy of mention, the kind of bush laid out in these gardens is the Chinese planted in clumps at distances varying from 6 × 6 feet to 4 × 4 feet. The appearance presented by many of the clumps of unpruned tea of various ages that may still be found in plantations in Kumaon, is that of small stunted masses from 1½ to 2½ feet in height, and about 3 feet or a little more in circumference. If examined, each clump will be found to consist of some gnarled and usually lichen-covered stems which give rise to a few crooked warty branches, that carry towards their tops a tangled crowded mass of short hard twigs, bearing some small leathery rather yellow-coloured leaves. A young healthy shoot coming straight from the roots is hardly to be found. At the appropriate seasons, this general appearance is modified by the presence of faint flushes of young and green leaves, by masses of flowers, and by loads of seed. Looked at from above, one of these clumps presents a rounded dense surface of small short twigs, and looks solid enough to afford a comfortable seat to a man of moderate weight! It need not be added that the yield of useful leaf on an acre of tea of this sort is but small. The condition above described is in some respects an extreme one, and is that assumed by unpruned tea in the higher plantations on the hills, where apparently the tea plant is fighting against heavy odds in the matter of climate, and is in a state where

* These heights do not profess to be exactly correct.

the *laissez faire* system of treatment is particularly inappropriate, and where a little attention to other operations besides pruning (such as hoeing and manuring) would produce the most marked effects.

In the moister, warmer, and in every way more genial climate of Dehra Dhoon, unpruned tea-clumps* are of greater size, and the stems and branches are less gnarled and lichen-grown. The leaves are also larger, and the flushes in the rains more vigorous. The yield of seed used in Dehra as in Kumaon to be large; and this fact is quite in accordance with general experience, for it is a matter of common observation that many species of plants, when grown under circumstances not natural and unfavourable to them, have an excessive tendency to run to seed, as if, feeling themselves to be in a dying way, they were determined to do their best as an expiring effort, to continue a progeny to another generation. The appearance of untended tea in the higher plantations of Kumaon is particularly suggestive of the existence of such a struggle for life against adverse circumstances.

As long as tea-seed remained a marketable commodity, there was some show of reason for continuing a system of cultivation, or rather no cultivation, which undoubtedly favoured its production in quantity, though the quality must have been poor; and doubtless pruning would have been resorted to sooner, had the demand for seed (concomitant with the mania for extending cultivation) ceased earlier. Both have now ceased, and such tea planters as still continue to carry on their gardens, now look to leaf, and to leaf alone, for their returns. Pruning has now begun to be generally practised; and in Dehra Dhoon indeed, every plantation has been submitted to the knife. The measure has not however always been either wisely, or well carried out. A few remarks therefore upon the facts and principles on

* At present, happily, only a few such exist.

which the operation is founded might be of use as guiding to a correct practice, and before going farther, it will be necessary to consider briefly the structure of the stems and leaves of plants, and their mode of nourishment and growth.*

The organs of flowering plants may be divided into *Vegetative* and *Reproductive*. The vegetative organs are those by which the life of the individual is sustained, and by means of which it grows; they consist ot root, stem, and leaves. The reproductive organs (consisting of flower, fruit, and seed) are concerned with the continuation of the species by the production of other individuals, and they are supported by the plant for this purpose. It is with the former set that we are now chiefly concerned. The structure of each and all of these parts (however much they may differ from each other in texture and external appearance) is fundamentally the same. Each consists of an agglomeration of vegetable cells. The vegetable cell, which is thus the ultimate element of vegetable anatomy, consists typically of a very minute spherical closed sac, with certain fluid and occasionally solid contents. It is in fact a tiny bladder filled with fluids and solids, the membrane being thin enough to allow of the passage of fluid through it. But although typically spherical in form, cells are rarely so in fact. Some are developed into ducts and cylinders of various sorts, for the transmission of fluids in the stem and leaves; others are lengthened out into spindle-shaped bodies, and made up into small faggots for the formation of wood; many are flattened into brick-like forms for the construction of bark, and into tiles for smoothing off the surfaces of the leaves; while an immense number are used as packing material or padding, and are stuff-

* It has not been thought advisable to introduce more scientific matter than was absolutely necessary: the account that follows of the structure and function of certain parts of plants, must therefore be accepted as only a rough one, which does not pretend to be complete.

ed in wherever there is a blank to be filled up in the internal structure of leaves. The pith of young plants is also made up chiefly of cells squeezed into a variety of shapes by pressure. But modified as they may be in form and function, they all remain essentially cells, and while young, the walls of all have the property of giving passage to fluids and gases. The cells in old wood, however, are exceptions, as their walls having become thickened, and their cavities obliterated, they are nearly, if not entirely, impermeable by fluids.

If the stem or branch of a tea plant be cut across and examined with the naked eye, the following parts will present themselves. In the middle of the stem, if it be an old one, there will be seen a cylinder of hard wood; * outside this, a circle of green young sap-wood; and encircling all, the layer of bark. When examined microscopically, the central cylinder of wood is found to be formed chiefly of spindle-shaped cells laid close together vertically, and with their tapering ends overlapping. In old wood, as has just been said, these have become incapable of transmitting fluid, and therefore of performing any vital function; and the wood formed of them is useful to the plant merely as a mechanical support. This explains how trees that have become hollow from the decay of the wood in the centres of their stems can continue, nevertheless, to throw out leaves, and to yield flowers and fruit. The structure of the encircling layer of young or sap-wood differs in no way from that of the hard wood, except that the walls of the spindle-shaped cells of which it is mainly composed, are thin and pervious to fluids, and the cavities of the cells are themselves filled with fluid. In stems of plants that have not attained a sufficient age, no central cylinder of hard wood will be recognisable. The

* In some trees the hard wood and sap-wood are of different colours. In Shishum (*Dalbergia Sissoo*) and Khair (*Acacia Catechu*) for example, the former is dark-brown, the latter yellow or whitish.

whole of the woody tissue will in such stems be found to consist of sap-wood, which will however be of greater density towards the centre. When the sap-wood is cut across, a greater or less amount of fluid will at certain seasons exude, and this is the layer which, in the language of gardeners, "bleeds" if cut while the sap is rising. Outside the ring of sap-wood is the bark which is composed of several layers, the inner of them being vascular and affording passage to fluids, the outer mainly protective.

The woody parts of the root of a tea plant, being in reality merely stems situated underground, will be found to resemble the stem-proper in structure. The real roots consist not of the woody parts which give mere mechanical support, but of tender fibrils which proceed from these. These fibrils are composed of cellular tissue permeable to fluids, and, as will be seen presently, they are the chief means by which the plant collects its food.

The leaf, which is anatomically but a flattened expansion of the branch, and which retains an organic connection with the branch, consists of a mass of loosely packed cells confined between two cellular membranes (which form the skin on its upper and lower surfaces) and penetrated by spreading bundles of fibres and vessels——the so-called "veins"——derived from the branch. These loosely packed cells, as well as the vessels of the leaf, are freely permeable by fluids. The root, stem, and leaves of which the above is a rough account, form the organs of a plant's digestion and assimilation, and therefore of its growth. The materials of its food must now be considered, and also the mode in which these materials are taken up and digested.

Plants cannot take in solid food. Whatever they absorb must be offered to them, either as a fluid or as a gas. The gaseous food of plants, in as far as it is absorbed in the state of gas, may be omitted from particular consideration at present. It is in the form of fluid that the great bulk of

their food is taken up. This fluid consists of the natural moisture of the soil, and of the various salts of the earth and of manures which that moisture may hold in solution, and is absorbed by the delicate root-fibrils which radiate in all directions in search of it. Collected from the soil by the fibrils, this undigested fluid is conducted to the stem where, avoiding the hard heart-wood, it passes into the part described above as the young or sap-wood layer, and, transmitted from cell to cell, passes upwards through the main stem along this layer, enters the corresponding layer in the branches, and finally reaches the flattened expansions of these which we call leaves. This ascending undigested fluid* is known as the *crude sap*. Having reached the leaves, and there becoming exposed to the influences of light and heat, this sap parts with a large amount of water by evaporation, and undergoes certain chemical changes. Thus altered in character (and as it were *digested*) by the processes to which it has been submitted in the leaves, &c., the sap is now no longer crude, but has passed into the condition in which it can be directly assimilated as nourishment by the cells of the plant. Up to this point the sap had been transmitted upwards in obedience to certain physical laws, and during the upward passage, probably no nutritive function had been fulfilled by it. Before parting with the fluid which they have thus elaborated, the leaves retain as much of it as they require for their own nourishment and growth, and the remainder they return to the branches and stem, mainly* through the vascular tissues of the inner bark, *i. e.*, the ring immediately outside the cambium. Passing downwards through these vessels as its main channel, the elaborated sap is distributed to all the growing parts of the branches, stem, and roots, and in fact affords

* The growth of the young wood takes place at its circumference and the growing layer is known to botanists as the *cambium*. This layer is also charged with descending sap.

to these, as to the leaves, the materials of their nourishment and growth. It is thus clear that the leaves are organs of very great importance in the economy of a plant's life, and indeed in the mutual interaction of these and of the roots, its life may be said to consist. The truth of this is well illustrated in the structure of the seed, which, in the class of plants to which tea belongs, contains the rudiments of two leaves and of a root, with sometimes a little store of nourishment in addition. The parent plant supplies these to its offspring to enable it to start in life, and the very first thing that offspring does, when, in the act of germination, it begins life on its own account, is to send the two embryonic leaves upwards, and the embryonic root downwards, and so begin the mutual process above-mentioned, and thus become a living thing.

The evaporation which takes place in the leaves, consequent on the exposure to the air of the crude sap in them, is a potent cause* of the ascent of that sap in the stem, and of its collection by the roots. As long as the leaves remain green and healthy and continue exposed to air and light, so long will the roots go on collecting from the soil, fluid which the young wood of the stem will transmit upwards in a steady stream. The vigour of the one process is accurately proportioned to that of the other. The roots will not long collect, neither will the young wood of the stem transmit, fluid for which there is no demand in leaves above. If from any cause the demand made by the leaves should be suddenly reduced, (as it would be by the removal of branches in pruning), the supply of sap which had been collected to meet the previous demand would thus become excessive,

* An excellent idea of the influence that is exerted on the ascent of the sap in the stem by its evaporation in the leaves is obtained from the results of Dr. Hale's experiments. He found, for instance, that the evaporation from a cabbage of medium size amounted, during twelve hours of a summer day in Britain, to nineteen ounces.

and the excess would be got rid of either by the discharge known to gardeners as "bleeding," or, by the plant making an effort to utilize it by rapidly putting forth new shoots and branches. Suppose for instance, that a tree in full health and vigour be cut down close to the ground; either of two things may happen, the sap in course of collection by the roots will either simply run to waste on the surface of the cut stem, or a growth of young shoots will spring up round the margin of the stump, or from the underground stem. Shoots originating in this way are known in Forestry as coppice, and the vigour and rapidity of growth shown by many of them, though often surprising, is easily explained when we consider that they are nourished by a root-system calculated for the leaf-system of a tree. If shoots arising in this way be persistently cut down as fast as they appear, and the root-system be thus deprived of all demand for its collections and as it were of all object in life, it will soon decay and die. It is needless to say that, on the other hand, the growth and vigour of the leaves are modified by circumstances affecting the roots, and that any injury to the latter soon tells upon the former.

Let us now consider for a little what the systematic "plucking" of the tea plant really amounts to, and what it is that the planter demands of the bushes in his garden. In the operation of "plucking," the plant is regularly deprived, during the season of active vegetative activity each year, of its young expanding leaves, and of the growing extremities of its branches. In other words, it is systematically deprived of the parts that are at once the organs of its digestion and the instruments of its growth, as fast as it provides itself with them. Were the deprivation complete, the plant would simply die. But, even in the most over-plucked plantations, it is only partial. Not only however does the planter thus continuously deprive the plant to a serious extent of the very organs of its life and growth, but he

demands that it shall continue for a series of years to be submitted to this process, and still to continue healthy and vigorous, or as he phrases it, to give good "flushes." Observe, too, the kind of leaves that the planter chooses to pluck. They are not old mature leaves, whose vital functions are sluggishly performed, and whose best days have past. The Tea plant being an evergreen, a large proportion of such might be removed without injury. It is not these, however, that are taken; but the young and growing, in which sap circulation is rapid and free, in which the vital processes are carried on with vigour, and to which the young branches bearing them, and indeed the whole plant, look chiefly for the materials of life. Where, as in the North-West Provinces of India, the planter has asked the plant to yield up these for a succession of years, while he on his part has given but small help in the way of manure and tillage, and denied even the cheap aid of the pruning-knife, it is not to be wondered at that tea planting has proved unsuccessful.

Inasmuch as the plant is a perennial one from which are annually gathered the majority of its growing leaves, the tea crop differs from every other with which we are familiar, except perhaps mulberry, which, as food for silk-worms, is also grown for its leaves. Most garden vegetable crops of which the leaves are the parts gathered, are the produce of plants which are expected only to yield a return to the grower once in their lives, (*e. g.*, Cabbage); or a return for a short season, (*e. g.*, Brussel's Sprouts), and then to die. They therefore present no parallel case to that of tea. The returns desiderated in other perennial cultivations than tea, are usually flowers or fruit, (or what is the same thing—seed), but never young leaves. Now the bearing of flowers and fruit is the natural consummation of a plant's life, and the removal of these after they have been produced does no harm to the producing plant *as an individual*, (on the contrary often benefits it), although the act affects its possible posterity. It is

true that, in order to force it to bear unnatural quantities of flowers and fruit, or flowers and fruit possessing unnatural qualities, the horticulturalist often exposes a plant to treatment which is injurious to it as an *individual*, and which leads to premature old age; at the same time it is treatment, which as regards flowers or fruit, is the most advantageous. In contrast to this is the action of the tea grower who, by the very collection of this crop, necessarily exposes his plants to treatment which, as regards a continuation of that crop, is disadvantageous.

In the cultivation of almost all kinds of fruit trees, the operation of pruning holds a prominent place. The problems respectively presented to the European grower of fruit and flowers, and to the Indian cultivator of tea being different, it is only reasonable to expect that different methods of practising that operation would be advisable. The general practice of pruning as carried on by European gardeners, is however founded, for the most part, upon a knowledge of the principles of vegetable physiology, and it is therefore also reasonable to suppose that Indian tea growers might have learnt a good deal, on the general subject of pruning from European writers on gardening, even although not venturing to put their plantations under the charge of practical European gardeners with full powers to do as they might deem best. Until within a year or two ago, however, the only kind of pruning attempted in the tea gardens of the North-West Provinces was the removal of wood actually dead, and the application on rare occasions of a hedge clipping-scissors, which delicate implement used to be entrusted to a native gardener (malee) with orders to reduce by its means certain bushes to a particular height, a stick of the required length being given to him as a measure. Indiscriminating treatment like this is the kind of pruning to which a few gardens in these provinces used now and then to be submitted. Rational pruning involves consideration and selection; and each

bush ought to be treated according to its own individual condition, and not in accordance with a rule of thumb laid down for an entire field or garden. It is only certain stems and branches to which, as a rule, the knife can be applied with advantage, and these for the most part are the ones that afford the most marked examples of the natural effects of "plucking." Now if we think of the matter for a little, the process of "plucking" will be seen to be really of the nature of *pruning*, and to recommend pruning as a cure for the evils of plucking, may therefore appear paradoxical. To explain the seeming paradox, let us consider briefly the appearances presented by a young shoot of tea before it has been deprived by the plucker of its tip with the three or four leaves or leaf-buds born thereon. Such a shoot bears on its entire length, let us say, ten leaves, and at the point where each leaf springs from the stem (*i. e.*, at the *axil*)* there lies a small bud. Each of these buds is capable of development into a lateral branchlet. In a branch bearing as we have supposed ten leaves, it is not probable that, were things left to their natural course, each of the ten axillary buds would become developed into a lateral branchlet. When however the growing point of the shoot is removed, these axillary buds are stimulated by the ascending sap, and most of them expand into lateral branchlets, and these being in turn topped by the plucker their axillary buds are stimulated, though in a less degree, into expansion into branchlets, and so on. The vigour with which lateral branchlets follow on "plucking" or topping the leaders, diminishes regularly with each repetition of the process, until after a few years of such treatment a period of nearly complete stagnation is reached, and the original ten-leafed shoot with which we started presents the appearance of a tough greyish-barked and often gnarled stem, bearing at its top a dense collection of small wiry twigs, which

* Derived from the Latin word *axilla*, the arm-pit.

carry a quantity of small thin tough leaves totally unfitted for manufacture into good tea. These twigs moreover are of such low vitality that when topped they hardly respond by throwing out fresh lateral shoots or "flushes." This is the kind of stem of which the clumps of unpruned tea already described consist. The reason of the smallness and non-activity of the leaves upon these brush-like masses, is simply that they have increased in number out of proportion to their means of nourishment. The stem, through the sap-wood layer of which their nourishment is transmitted, has not increased proportionally with the number of the leaves which have been forced into existence by the operation of plucking; and it is a physical impossibility that, through the layer of sap-wood in the stem, there *can* be transmitted enough sap to support many young leaves, in addition to the old ones with which its top is crowded. Were such a stem left to itself, and all plucking suspended for a time, it is probable that in some cases an equilibrium would be established between the leaves and sap-wood, and that the latter would again become extensive enough for the transmission of sap sufficient to support a natural succession of young leaves, or in other words, to "yield flushes." But the process of recovery would involve time, which to the tea planter means money. A quicker way therefore of obtaining leaf must be tried, and this is found in pruning off the profitless wiry spray with which the stem is crowned, so that the sap transmitted upwards may cease to be dissipated away in the support of leaves which can never be made into tea, but which as long as they remain on the plant must have their needful supply of sap; and further, that the sap may be directed into the new shoots which the plant may be expected to throw out after the pruning. It is thus that pruning becomes the necessary sequence of plucking, if healthy young leaves fit for tea-making are sought to be continuously produced. The end in view should never be lost sight of when using the knife,

for the mere meaningless mutilation of a plant by its application is quite as likely to be hurtful as not.

It is extremely difficult to get native workmen to understand the kind of stems and branches they are to remove, and it will require much ingenuity and care and incessant watchfulness on the part of a manager to keep them from doing harm. As is the case with many other matters, it is infinitely easier to prune badly than to prune well; but there are few operations where the difference in results between bad and good work is more striking. In order to prune really well, each clump ought (as has already been said) to be treated on its own merits; but as it is pretty nearly hopeless to think of getting native workmen who are capable of doing this, it would be necessary for the manager, (after having clearly defined to himself what it is that he wants to effect, and the best way of doing it), to give his pruners a general idea of the kind of measures suitable for each patch of tea in the garden as they come to go over it, illustrating to them practically what kind of stems and branches should be cut quite away, what kind should be merely trimmed, and what left entirely untouched.

It might be safely impressed on tea pruners as a fundamental maxim, *that old wood is to be cut away within a few inches from the root,* for it will generally be found that such wood bears no leaves of which good tea can be made, but merely the small thin sluggish sort that are carried by the broom-like masses of spray already described. As a rule then, the best thing that can be done with hard old stems is to cut them off low down, in the hope that fresh new shoots may as a result spring from the root, or from the collar as gardeners phrase it. By the removal of these, not only are a quantity of useless leaves prevented from preying on the sap, but light and air are secured for the young shoots that will spring up. In old unpruned plantations, or on such as have been overplucked, the proportion of such broom-bearing

old stems is very great. Clumps formed of them are often very handsome and healthy looking, and thus are very deceptive. If a large clump be entirely composed of such brooms, it is a question whether a certain number of them should not be spared until a succeeding year, to carry on as it were the life-work of the plants, and not to trust entirely to the new start in life which a clean sweep of all would necessarily involve. When we consider the influence that leaves have in promoting the collection and transmission upwards of the crude sap, it does appear more rational to leave a certain number of these old stems for one season, so that by their means sap may be attracted and elaborated for the benefit of the young root-shoots which may be expected to appear as the successors of the stems that may be removed. Stems thus spared ought however to be cut away in the next year, by which time the young shoots will have acquired some size, and will carry a number of leaves. If the mode be adopted of at once cutting down to the root the entire clump, the pruner of course accepts the chance of the roots sending up no young shoots at all, and therefore dying, a result which for reasons above explained is quite possible, and the possibility of which should always be borne in mind.

In tea growing in unsuitable localities or in poor soil, and in tea which has been prematurely plucked, it is often the case that each stem in a clump represents a plant, (in other words that a plant consists of but one stem), and to prune entirely away such a stem would therefore be to cut down or coppice an entire plant, which as we have just seen is to run the risk of killing it. A wise precaution in dealing with such weakly clumps would be, *first* to deep-hoe and manure the soil round them, so as to get them into a little better heart, then to prune gently, and finally to cut down by the root during the succeeding cold weather. It is of course a question whether it would not be cheaper in dealing with such unhealthy tea to run all risks, and to

cut it down to the ground at once.

The old hard stems of which we have been treating, may easily be recognised by the appearance of their bark, which, often gnarled lichen-grown and warty, is always grey in colour. Younger stems, on the other hand, are of a brownish colour, and often marked with dark lines. If a clump is very thick and close, and the young stems are twiggy above and yield small leaves, some of them may be cut away by the root, but the majority of young stems should, as a rule, merely be trimmed a little by being relieved of their most wiry twigs.

In many clumps, there will be found springing straight from the root, a few long lanky shoots, which bear their leaves far apart and do not branch. These have probably been unnaturally "drawn up" owing to want of air and light. They are never likely to be of much use, and, if in the way, should be removed.

Young and vigorous stems ought not to be touched with the knife.

It is not necessary to go into details with regard to the treatment of younger clumps of tea which have not been over plucked, and which therefore do not abound in broom-bearing stems.

The general principles already insisted upon should be carried out, and after the pruner has finished with it, each clump ought to consist of young healthy stems with fresh looking bark which do not branch too much, nor end in the wiry spray so often alluded to. The height and circumference of clumps will depend on their age, and on site and soil. Each clump should be open and sparse enough to admit air and light to its centre, and no particular form should be insisted on as a pattern to which all are to be made to conform. Each should on the contrary be of the form most suitable to its condition and requirements. Experience alone will teach the comparative severity or lightness of pruning which will be most advantageous to the different varieties of

the plant, and in different soils and situations. Generally, pruning should be done when the sap is down and the plant is at rest, which with the tea plant is the case in the cold weather. The rains having ceased, and the ground during the early part of the cold weather having been deeply hoed and manured, whatever pruning is contemplated ought to be begun at once, and finished with all convenient speed, so that the plants may have time to recover themselves before the sap begins to rise and the flushes to appear.

The frequency with which this operation is to be repeated must be determined by the condition of the plants, but probably a light pruning would be advantageous every year, if it could be managed.

Pruning such as has been recommended cannot be practised successfully on one set of bushes for ever. A time must arrive when they will cease to respond to the calls upon them, and to begin to yield but poor and small leaf, and little of it. Entire exhaustion will eventually follow, but we have yet to learn how long under such a system they will continue to yield *profitably*. With generous treatment they may, probably do so until they are 15 or 20 years of age, or even older; but the wise planter will provide for the future by laying down year by year new patches of bushes to succeed the old.

It has not been the object of this paper to treat of other matters connected with tea cultivation. I would merely say in conclusion, that to ensure success, pruning must go hand in hand with deep hoeing, careful weeding, and manuring. If these, the essentials of all gardening and farming be attended to, and intelligent efforts be made to get good seed for the future by rigidly selecting the best bushes as seed-bearers; if a system of closer planting than now prevails be adopted; if rational plucking be practised; and increased care be taken in the manufacture for the market; there is every reason to believe that tea growing in the North-West Provinces of India may yet become a great and successful enterprise.

MARCH, 1871.

Random notes about Gardens: by Major T. M. Shelley.

It may be fairly conceded that our public and private gardens are in a very backward state; there are exceptions, but as they do not prove the rule we may be pardoned for taking a general view, especially as the object of these notes is to promote their improvement.

Looking around on all sides, we cannot shut our eyes to the fact that they have not kept pace with the times, neither have they met the requirements of the land we live in. In many stations there are rooms for assembly, and subjects for discussion take a wide range, sanitation, road, schools, municipal works, imperial works, and we might add topics "ad infinitum," but we never hear a subject proposed, tending to the improvement of our gardens or the education of our gardeners. We find men providing, with a keen discrimination, wines for their table, searching the recesses of cellars, and content to pay any demand for a high class article; we hear the highest encomiums upon the wine, we see the overgrown turkey and the *under*-grown potato, we see the contents of several late hermetically sealed tins, but we never hear the question asked, how is it that our vegetables are the least enjoyable portion of the meal! To say that India *cannot* supply us with good condiments, is a fiction; but to say India *will* not, is a truth alas too true!

We will touch gently upon the subject of gardens, as we hold an opinion that they have no deep root in the affections of the multitude: they are like young vines, they want all the attention and support we can give them. Let us visit the garden of our neighbour, with no view to criticism but

for information; we walk round his many beds and see much to admire, we know him to be a pains-taking man, every thing is in order, the visit has given us pleasure, and we tell him so. He replies by praising his malee and attributes the success to strict attention to orders, and having gained the admiration of his friends with something to shew for his labor, he rests satisfied that nothing further is necessary. But we think that when he has thus gathered his fruits, he has another duty to perform; he has to explain the cause of his success, but this is left undone, he takes no pains to instill into the gardener's mind why he has succeeded, so that the gardener can never reveal his experience and too often thinks *when* he can, that it is his master's secret, so he in his turn rests contented believing that the garden is for his master, its produce for his table or that of his friends. Thus some of the finest garden productions, sufficient to exite admiration and wonder, and their lesson-teaching mission, and what might have done good to many, is lost beyond recalling; and science, who has proved her principles, lapses into oblivion until again called forth by experience.

From private gardens India has received some of its grandest additions to agri and horticulture; taste brilliant and choice has guided the amateur's selection, and the result has been additions to health, comfort, and science; but as a rule these gardens are too exclusive; the seasons come, the seasons go, seed succeed seed, and like begeteth like, and there is no general good; for all that is done is contained in a ring-fence, of which the outsiders knew nothing. This style of gardening in a country well stocked and replete might be tolerated, but this selfish view is one cause of our present indifferent gardeners; we must abolish this ring-fence and let our friends and foes, if you will, see what the earth can bring forth by the labor of man.

Let us now speak of public gardens and see how their present system of working is compatible with the advancement

of horticulture. We may divide this subject into botanical gardens, gardens partly supported by government, and those entirely dependant upon their produce for support. Our botanical gardens, under the direct control of government, are models in themselves, as far as the purpose for which they were intended is concerned, as living museums of instruction; but we very much doubt if the outlay expended upon them bears a high fractional comparison with the good they are supposed to do. To make these gardens tasteful to our native students, we must establish a botanical class at all our great Indian colleges, and when students have learnt the theory, let them as a part of their course visit these gardens for practical study. But are we not treading upon financial soil in expecting government to furnish the outlay, especially when we see men like Hutton and Pogson ready to publish practical knowledge gained in the country for the benefit of government, and the population, quietly shelved with "government declines at present," or in its munificence is willing to pay for 5 or 6 copies. We can fancy the utility of 5 or 6 copies for the whole of the government gardens of British India, and we can also imagine the disgust of scientific men at so indignant a reception of valued time and labor condensed into pages of valuable information; the whole to be lost to the world for the sake of the "comptant."

Let us pass by these gardens to gardens partly supported by government, not of a botanical nature: these may now engage our attention. We decline to enter into any controversy whether the sum allowed is sufficient or insufficient for any practical good; we simply take them as we find them usually. The garden is under a Secretary or President chosen for his social position, and frequently because no one else will give the time and labor necessary for the general welfare of the garden with special reference to its paying capabilities. About the last question asked is, has the proposed President or Secretary any general knowledge of gardening? Is he ac-

quainted with the soil he is about to take under his protection? Has he any horticultural taste? Were these and similar questions to be asked, and the election to depend upon the answers, the gardens would be no losers.

How often have we seen seed of the finest kind imported by men who have made the climate of India their long study, so that seed and climate should work together in unison, utterly destroyed by men ignorant of all that relates to its cultivation. As well might the sower expect "to gather figs from thistles," as to try and make a season for his seeds, in place of suiting his seeds to their season. Let it not be understood that general incapability is supposed to exist to such a normal extent, that light and darkness are balanced; this would be unjust. Descending from great to small with an abrupt step we alight upon the working gardener; he is generally from the home country, not imported for the important duty he undertakes, but recruited from Recruits, a class little given to horticulture; we will admit he may have served his full period of service or bought his discharge, if the former he wants recent experience for his labor, if the latter, and worth having, *he may* be an acquisition.

The source from whence the head gardener is obtained is named merely to shew how far from the fountain head it is possible to go for labor, before the expense is thought worth incurring for obtaining a good practical man from one of the many large nurseries in England. We thus see that our public gardens above noted must to some great degree depend upon the uneducated malee for their existence, and so long as he can give subscribers value for their subscriptions, all goes well, but where is the improvement for the Government outlay, and how far does it extend beyond the limits of the garden walls?

There is another class of gardens to notice, the self-supporting; they are well worth a visit and extremely interesting, as they are worked to suit the community around them, black

or white; there is a business look in each bed devoted to business; in the water courses may be seen a few native flowers for garlands; roses here and there, with a hubble-bubble stowed away in a private spot known only to the initiated. In the strict growing season supplies of a kind are abundant, and the garden is equal to the demand, as certain portions are cultivated to be ready for consumption monthly, consequently there is a silvery stream running into the exchequer advantageous to the owner. We find this has been going on from time immemorial, little or no innovation is sanctioned; new seed has, by dint of favor been introduced and made over to the malees trinity,—black earth, water and kismut! carefully cherished in a remote corner where the foliage is the thickest and darkest: death comes to the rescue, which is a sufficient answer that the soil and climate are unsuitable. This kind of money-culture, for we find it hard to give it a better name, is what we daily see in our several stations, and how few are there among us who will try to elevate and improve them. The common saying "tis not my business" is soon the common thought, and the common thought leads to indifference. Thus society is content to receive small under-grown ill tasted supplies, because ignorance is allowed to reign.

Having seen the short-comings of the gardens of India, also the little encouragement to be expected from Government and from the multitude in general, it is clear that it behoves those interested in their general welfare to take steps necessary for their advancement: therefore to those entrusted with the management of public gardens we would say, if it is possible, by all means import European supervisors; let the eye no longer see choice exotics, able to live, and glory in their transportation, fade and pass away, because all concerning them is unknown; do justice to the garden, and see if theoretical, practical, and linguistical talent will not raise its standard,—for one thing is certain it cannot lower it;—let it be known wide and far that natives may come and learn from experience,

as they have little faith in theory; and they will not be backward in throwing bread upon the waters, to reap the fruit thereof for their own benefit, and those of their fellow countrymen.

Again, institute station societies, hold meetings and exhibitions, reward merit, let the most successful producer know that his talent is appreciated, and warmly applaud those who have made honorable attempts; then and not till then may we expect our gardens to be what they ought to be,—Grand Exhibitions of reproductions. It is written "behold I have given you every herb bearing seed which is upon the face of all the earth, and every tree, in the which is the fruit of a tree yielding seed, to you it shall be for meat."

Report on the germination of the Vegetable Seeds imported by the Society in 1871; *by* JOHN SCOTT, ESQ., *Curator of the Royal Botanical Gardens.*

With reference to the vegetable seeds which you sent me for trial, I have pleasure in submitting a tabular statement of the results, these summarised show that of the 65 kinds supplied by Messrs. Barr and Sugden the germination is 17 at 15 *per cent.*, 18 at 41·7, 10 at 67·5, and 20 at 91· Those from D. Landreth and Sons comprising 41 sorts, afford 5 at 13 *per cent.*, 9 at 42·7, 11 at 65·10 and 16 at 93·12. The results are thus I think very satisfactory, and this the more especially in taking into consideration the late extreme humidity of the atmosphere: such conditions being much less favorable to the germination of seeds from temperate climates than the dry though higher temperature of the hot season.

13*th June*, 1871.

Report on Vegetable Seeds for 1871.

	From Messrs. D. Landreth & Sons.			From Messrs. Barr & Sugden.		
	No. of Seeds sown.	No. of Seeds germinated.	100	No. of Seeds sown.	No. of Seeds germinated.	100
Asparagus, Large Purple-top	20	15	„ 75	„	„	„
„ Dutch Giant	„	„	„	20	11	„ 55
„ Covent Garden Giant	„	„	„	20	4	„ 20
Artichoke	20	1	„ 5	„	„	
„ Purple Globe	„	„	„	20	1	„ 5
„ Green Globe	„	„	„	20	2	„ 10
Beans, Red French	20	17	„ 85	„	„	„
„ Scarlet Runner	20	18	„ 90	„	„	„
„ Large Lima	20	16	„ 80	„	„	„

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Report on Vegetable Seeds for 1871. *(Continued).*

	From Messrs. D. Landreth & Sons.			From Messrs. Barr & Sugden.		
	No. of Seeds sown.	No. of Seeds germinated.	100	No. of Seeds sown.	No. of Seeds germinated.	100
Beans, Dwarf French	„	„		20	20	„ .00
„ French Dwarf Kydney	„	„		20	16	„ 80
„ Dun Dwarf French	„	„		20	20	„ 100
„ French or Dwarf Kydney Bean brown speckled ...	„	„		20	18	„ 90
Beet, Long Blood Red	20	15	„ 75	„	„	„
„ Globe Blood Red	„	„		20	10	„ 50
„ Dwarf Deep Blood Red	„	„		20	15	„ 75
Brocoli, Purple Cape	20	11	„ 55	„	„	„
„ Champion	„	„		20	2	„ 10

Basil, Sweet	20	2	,,	10	,,	,,		,,
Cabbage, Early York	20	18	,,	65	,,	,,		,,
,, Purple Turnip Rooted	20	15	,,	75	,,	,,		,,
,, Red Dutch	20	16	,,	80	,,	,,		,,
,, Early Sugarloaf	20	12	,,	60	,,	,,		,,
,, Drumhead	,,	,,			20	14	,,	70
,, Barr's Miniature	,,	,,			20	13	,,	65
,, Enfield Market	,,	,,			20	15	,,	75
,, Large Oxheart	,,	,,			20	13	,,	65
Cauliflower, Asiatic	20	11	,,	55	,,	,,		,,
,, Walcheren	,,	,,			20	11	,,	55
,, Half Early Paris...	,,	,,			20	12	,,	60
Carrot, Early Horn	20	6	,,	30	,,	,,		,,
,, Long Orange	20	10	,,	50	,,	,,		,,
,, Altringam	,,	,,			20	6	,,	30
,, Long Red Surrey	,,	,,			20	4	,,	20

Report on Vegetable Seeds for 1871. (Continued).

	From Messrs. D. Landreth & Sons.				From Messrs. Barr & Sugden.			
	No. of Seeds sown.	No. of Seeds germinated.	100		No. of Seeds sown.	No. of Seeds germinated.	100	
Celery, White Solid	20	8	,,	40				
,, Red Solid	20	4	,,	20				
,, Purple Giant	,,	,,			20	7	,,	35
,, Fine Dark Red	,,	,,			20	8	,,	40
Cress, Curled or Pepper Grass	20	7	,,	35				
,, Triple Curled	,,	,,			20	3	,,	15
,, Plain	,,	,,			20	9	,,	45
,, Golden or Australian Cress	,,	,,			20	15	,,	75
Couve Tronchuda	,,	,,			20	14	,,	70

Cucumber, Early Frame	10	5	,,	50				
,, Long Green Prickly	,,	,,			10	5	,,	50
,, Gherkin Cucumber	,,	,,			10	4	,,	40
Endive, Green Curled	,,	,,			20	8	,,	40
Fennel	,,	,,			20	8	,,	40
Geum, Barr's Emerald	,,	,,			20	2	,,	10
Kohlrabi or Knol Kohl, Turnip Rooted Cabbage Purple ...	,,	,,			20	16	,,	80
Kohlrabi or Knol Kohl, Turnip Rooted Cabbage Purple ...	,,	,,		,,	20	16	,,	80
Lettuce, White Cos	20	20	,,	100	,,	,,		,,
,, Royal Cabbage	20	2	,,	10	,,	,,		,,
,, Grand Admiral	,,	,,		,,	20	4	,,	20
,, Paris White Cos	,,	,,		,,	20	2	,,	10
Leek, Flag	,,	,,		,,	20	3	,,	15
Mustard, White	20	20	,,	100	20	19	,,	95
Marjoram, Sweet	20	10	,,	50	,,	,,		,,
Melon, Queen Emma Flesh	,,	,,		,,	10	4	,,	,,

Report on Vegetable Seeds for 1871. *(Continued).*

	From Messrs. D. Landreth & Sons.			From Messrs. Barr & Sugden.		
	No. of Seeds sown.	No. of Seeds germinated.	100	No. of Seeds sown.	No. of Seeds germinated.	100
Onion, Yellow Strasburgh	20	7	„ 35	„	„	„
„ White Spanish	„	„		20	2	„ 10
„ Silver Skinned	„	„		20	3	„ 15
Peas, Blue Prussian	20	20	„ 100	„	„	„
„ Early Frame	20	19	„ 95	„	„	„
„ Black-eyed Marrowfat	20	20	„ 100	„	„	„
„ Bishop's Dwarf Long Pod	20	20	„ 100	„	„	„
„ Royal Dwarf Marrowfat	20	20	„ 100	„	„	„
„ Champion of England	20	18	„ 90	„	„	„

" Blue Imperial	20	19	" 95	"	"	"
" Landreth's Extra Early	20	20	" 100	"	"	"
" Victorian Marrow	"	"		20	20	" 100
" Dillstone's Early	"	"		20	17	" 85
" Tall White Flowered Scimitar Sugar	"	"		20	19	" 95
" Dwarf Dutch	"	"		20	20	" 100
" Knight's Dutch	"			20	20	" 100
" Auvergne	"	"		20	19	" 95
" Knight's Dwarf Marrow	"	"		20	20	" 100
" Daniel O'Rourke	"	"		20	19	" 95
" Veitch's Perfection	"	"		20	12	" 60
" Burridge's Eclipse	"	"		20	20	" 100
Parsley, Curled	20	4	" 20	"	"	"
" Dunnett's Garnishing	"	"		20	6	" 30
Parsnip, Hollow Crowned	"	"		20	2	" 10
Radish, Scarlet Turnip Rooted	20	10	" 50	"	"	"

Report on Vegetable Seeds for 1871. *(Concluded).*

	From Messrs. D. Landreth & Sons.			From Messrs. Barr & Sugden.		
	No. of Seeds sown.	No. of Seeds germinated.	100	No. of Seeds sown.	No. of Seeds germinated.	100
White Turnip	20	14	„ 70	„	„	„
„ Wood's Long Scarlet...	„	„		20	20	„ 100
„ Mixed Turnip	„	„		20	9	„ 45
Sage	20	9	„ 45	„	„	„
Squash, Hubbard	10	6	„ 60	„	„	„
„ Mixed	„	„		10	8	„ 80
Scorzonera	„	„		20	3	„ 15
Salsefy	„	„		20	5	„ 52
Sea Kale	„	„		20	4	„ 20

Salad Corn	,,	,,			20	7	,,	35
Spinach, Landreth's Round	,,	,,			20	6	,,	30
Tomatoe, Large Red	20	13	,,	65	,,	,,		,,
,, Pear-shaped or Love Apple	,,	,,			20	8	,,	40
,, Large Red	,,	,,			20	10	,,	50
Turnip, Yellow Aberdeen	20	19	,,	95	,,	,,		,,
,, Early Dutch White Flat	20	18	,,	90	,,	,,		,,
Turnip, Early White Dutch	,,	,,			20	13	,,	65
,, Beck's Improved Snow Ball	,,	,,			20	17	,,	85
Thyme	,,	,,			20	5	,,	25
Vegetable Marrow	,,	,,			20	10	,,	50
Watermelon, Mountain Sweet	10	7	,,	70	,,	,,		,,

ROYAL BOTANICAL GARDENS,
14th June, 1871.

JOHN SCOTT,
Curator,
Royal Bot. Gardens.

THE GARDENER'S NOTE BOOK, No. 14.

A simple and successful mode of propagating Plants; by COLONEL C. S. RYDER.

I note that in the list of cuttings available at the Botanical Gardens, published in the Journal, it is mentioned that the *Bougainvilleas* among others "will only strike in sand beds under glass.'

I found the following plan perfectly successful at this station.

In the earlier part, and about the middle of the rains, I got small baskets, the same as the coolies use for carrying earth, filled them with good earth from the garden, and placed them in the verandah on empty flower pots or on three bricks each. I then put the cuttings in about two inches apart, not using the very young ends of the shoots. They were watered twice every day and, as a rule, every one succeeded. I found that the baskets succeeded with cuttings of all kinds especially heliotrope, verbena and lobelia; geraniums never failed, and I have no doubt that the plan would succeed with many plants which have been difficult to raise from cuttings.

I believe that the success is due to the perfection of the drainage and the free admission of air to the soil.

THE GARDENER'S NOTE BOOK, No. 15.

Note on the culture of the Strawberry at Morar; by MAJOR T. M. SHELLEY.

You ask me for a note upon my success in strawberry growing, and I have much pleasure in giving it. I had been duly warned and cautioned by residents, that I should not suc-

ceed, as so many had failed, one gentleman telling me he had tried five thousand plants, and had succeeded in saving three in *flower pots*, rather as curiosities he looked upon them than as plants able to produce so agreeable a fruit. Setting aside the caution, I obtained plants from the Hills at their season of rest, consequently had no difficulty in bringing them to Morar. I planted them on ridges five inches high, using no manure of any kind on account of the white ants, and watered freely every third day. The plants were placed nine inches apart, flourished and fruited well, giving out an abundance of suckers, in April. About the middle of May the hot winds and white ants were the means of several fine plants dying. To remedy the first evil I covered them with *jhamps*, and for the latter evil I watered freely daily. These two precautions had the desired effect, and my plants are now in robust condition. I purpose taking the plants up, as the rains have commenced, and packing them tightly in half tubs under shelter in an eastern aspect, to prevent the rains rotting them off: this step I was advised to take by Mr. Doddridge of the Agra gardens, who has learnt the lesson by actual experience, and I have no doubt of its wisdom. I would recommend growers to avoid the Hautbois as it usually proves sterile in the plains running to leaves. To those who have faith in manure for the *Fragraria vesca*, by all means let it be liquid, and to make certain of strong young plants, nip off the runners when they exceed three; at the time the plants are about to put out runners, fill up the trenches with light sandy soil mixed with a little leaf mould. This enables the young plants to strike quickly, giving no encouragement to white ants to pay a visit: and lastly water freely, and plant out about the 20th October on ridges.

Notes on a flowering plant of Vanda Batemanni, on flowering specimens of Arundina bambusæfolia, and on Dendrobium Andersonii; by JOHN SCOTT, Esq.

Vanda Batemanni has now flowered with us for the first time, and I have much pleasure in sending you the large and handsome specimen for exhibition at your next monthly Meeting, on the 13th July. You will observe how distinct it is from any of the other species with which we have any acquaintance; and from its rarity here, it may be well to put on record the following description of the specimen:—It is a stout erect plant, 42 inches high, giving off from its base several elongated and very thick aerial roots: the leaves regularly two—ranked in 6 pairs; somewhat curving sword-shaped and keeled, obliquely emarginate and obtuse, of a firm, thick and leathery texure, and from 12-20 inches in length by 1¼ in width. The flowers are borne on a stout, elongated and erect, axilliary raceme—38 inches high and bearing 18 flowers: the fully expanded flowers are about 2½ inches across; sepals somewhat wedge-shaped, obtuse of a firm leathery texture; bright yellow, and freely spotted with pale crimson in the front, while the back is of a clear purplish violet colour; the lip somewhat scimitar-shaped with a hooked and acute apex, of a similar but deeper colours than the back of the sepals; the base saccate and auricled with a white and violet tinged heel. The flowers are very lasting; the lower ones on the raceme having been already expanded about a month and a half..................The simplified structure of the lowermost flower on the raceme is noteworthy: observe that the perianth consists of two whorls, each having a single pair of opposite segments; whereas in the normal state each is composed of three segments, and one of which, in the inner whorl, is the curiously-shaped lip. In the above abnormal state we find that the two lateral sepals of the outer circle are united to each other throughout their whole

length, and are opposite to the upper or anterior sepals: in the inner circle the lateral petals are opposite and the odd one or lip is entirely suppressed: the column is also much reduced in size, the pollinia nearly abortive, the caudicles and discs being however perfectly developed.

"The honour of discovering this splendid thing,"—writes the late Dr. Lindley,—"is due to M. Gaudichaud, who met with it in the Moluccas; of introducing it to Britain, to Mr. Cumming, who sent it from the Philippines; of first flowering it, to Mr. Bateman, with whom it produced its magnificent sceptre in the stove at Biddulph Grange in June and July 1846." The *Vanda Batemanni* and several other equally rare Malayan and South American orchids were first successfully introduced to our collections here in 1866, by Mr. Lynam, Superintendent of Police; but being indented for from a London nursery-man, the *Vanda Batemanni* (which is still a rare and costly plant, and then only to be had of a small size,) has not yet borne flowers. The specimen now exhibited was introduced by Mr. S. Jennings from Singapore, along with the *Vanda Lowei* in 1868, and contributed to the Botanic gardens, on that gentleman's leaving for Allahabad.

2.—* *Dendrobium Andersonii nov. sp.*; stems terete, suberect, slightly hairy, ultimately glabrous and of a pale yellowish-green colour changing to ash-grey. The leaves two-ranked, oblong-ovate, obliquely rounded and apiculate at the apex, glabrous and of a bright glossy green. The flowers terminal in pairs; the bracts small ovate, cuspidate; the sepals ovate-lanceolate, acuminate, 1¾ of an inch long by 5 lines broad, the lateral ones somewhat falcate, prolonged at the base into a tapering obtuse and curved spur, about ¾ of an inch long; petals ovate-acute broader than the sepals; both being of a pure white; the lip three-lobed, lateral

* Not being in flower I submit a colored drawing.

lobes short entire and rounded; the middle one oblong-ovate, with an acute and recurved apex; and wary and crenated margin somewhat shorter than the petals; the base saccate and veined; the veins towards the base of a clear reddish orange on a white ground; it flowers in June, the individual flowers retaining their beauty for from two or three weeks.

This beautiful and aromatic-scented species has a considerable resemblance in habit to the dwarfed and erect Khasia Hill form of *D. formosum*, from which, however, it has very different flowers. It is one of several handsome species of orchids contributed to the Botanic gardens here by Dr. J. Anderson, from the Yunnan expedition in 1868, and it has now flowered for the first time.

3.—*Arundina bambusæfolia* is not an uncommon orchid in Eastern Bengal, and abundant in many parts of the Khasia Hills and Assam, whence it extends along the tropical vallies of the Himalayas to Sikkim and Nepal; it is the *Cymbidium bambusæfolium* of Roxburgh. I have been induced to exhibit flowering specimens of it at this meeting of the Society by Messrs. Bartlett and Lynam, who inform me that it is very rare in Calcutta gardens, and that neither of them had previously seen it in bloom. Thriving, as it does, well in Bengal, under out-door culture, and having large and beautiful flowers, I am certain that it will be more generally cultivated when better known. It is an evergreen terrestrial orchid, with an erect, shrubby stem of from 3-8 or even more feet high—according to the less or more favourable conditions under which it is found. The leaves are two-ranked, lanceolate-acuminate, the margins revolute, perfectly smooth and of a pale shining green, from 7-12 inches long by 6-9 lines broad. The flowers are borne on more or less elongated terminal racemes or large and spreading panicles; each flower being subtended by an acute membrano coraceous bract. The sepals are oblong-laceolate, with a callous apex, about 2 inches long by 5 lines broad; the petals are about twice the breadth of the

sepals with an acuminated apex; and all stained with a pale rosy-pink; the labellum or lip embraces the column at the base and terminates in a broadly-oblong, oblique, reflexed two-lobed limb; three-crested along the midrib and of a beautiful purply-pink with crimson veins, the throat stained with violet and the apex of the crests yellowish white—2½ inches long by 2½ broad: the individual flowers last about six days; while the flowering season extends from February to about the end of the rains.

In the Botanic garden here it is grown very successfully in an open compost of lumpy charcoal, koor, leaf-mould and sand; the gumlahs containing the plants being of large size are sunk in the borders amongst some brick-rubbish to secure a better drainage; for though I have seen them in water-logged sites, in their native wilds, I have found that in culture (especially the younger plants) they are apt to suffer from the stagnation of water at their roots. In the cold season they should be kept dry, until they begin to flower in February, when they may be watered at the roots; at first sparingly, increasing as growth advances, until the rains set in, when the natural fall will fully suffice. It is one of the few of our terrestrial orchids which indifferently affect the moister and shadiest parts of the forest, and dry, sunny and sandy banks, and thus thrives exceedingly under full exposure in our gardens. It may be readily increased by division of its roots, though one is naturally loath to disturb by such divisions, the symmetrically spreading specimens, which they soon form, after being fairly established.

Tobacco Cultivation, being a brief abstract of Dr. FORBES WATSON'S *Report on Tobacco, by* P. ROBINSON, ESQ.,—(*Communicated by* H. RIVETT CARNAC, ESQ.)

"The introduction of a system of cultivation and preparation of tobacco possessing first-rate qualities, requires so

much care that it can only be successfully attempted by means of experimental farms."—DR. FORBES WATSON.

The seed-bed.

(Supposing the area of ground on which the experiment is about to be tried to be an acre).—Enclose with a wall (brick) about one foot and a half high a space five feet broad by twenty-five feet long. Dig out the soil enclosed to a depth of two feet, replacing the soil removed by two feet of strong stable manure. When this begins to ferment (to steam), cover with six inches of prepared earth and sow the seeds.

Sowing the seed.

To sow the seed more carefully, mix it with white wood-ash, and scatter the whole equally over the surface of the prepared ground (the seed ought to fall about four to the square inch, but with so small a grain as tobacco, it is impossible to be exact), and cover with an inch of good mould.

After-care for the seed.

After sowing, water the seed-bed with a fine-rosed watering pot. The sowing bed should be provided with a reed-mat covering, which after watering should be stretched across from wall to wall. This covering should be taken off (to allow the steam from the manure to escape and to admit fresh air) for hours every morning and every evening.

Three days after the first sowing, the bed should be watered again.

N. B.— water in the early mornings.

Pricking out.

In about a week the plants should appear, and, when they seem to crowd, should be pricked out, leaving distances of one inch each way round each plant, thus :—

N. B.—The spare plants should be preserved for filling up gaps in the rows when transplanted.

When the plants have developed four or five leaves, any one of which is an inch broad, they may be transplanted. The seed-bed should be watered in order to make the pulling up of the plants easier, and when pulled up the plants should be removed quickly as possible to the site prepared for them.

Planting out.

This site (supposed to be an acre in extent) should be level ground and exposed; a fence should be round it to protect it from jackals, &c. The soil should have been ploughed deep twice before the plants were put in, and afterwards harrowed and rolled carefully.

The tobacco field.

It should have a fine light soil with a firm loamy subsoil, manured with strong ammonia manure at a ton per acre with a free distribution of vegetable remains.

The soil.

The site of the tobacco plantation should be changed every two years, as tobacco is a most exhaustive crop.

Tobacco an alternate crop.

N. B.—Sun-flower would alternate with it well.

The plants should be planted in rows two feet apart, each plant two feet from the next, a pathway being left for the coolies between (not every row but) every two rows. A broader pathway (five or six feet broad) should intersect the plantation at right angles, forming at the point of intersection a convenient space for heaping the leaves.

The plant of the field.

When the plants have been set out water well. (*N. B.*—the watering pots used should have very finely perforated roses) and if any plants die, fill up the gaps with spare plants from the seed-bed.

Watering.

After a day or two hoeing should commence. The hand is the best instrument, and the workmen should be told to kill every in-

Hoeing.

sect they see except ants, and to heap the earth carefully round the stems.

Pruning.

If the plant threatens to be very leafy, remove superfluous leaves, leaving about fifteen to a plant. When the flower-buds are plainly noticeable, they must be picked off with great care. *N. B.*—For fancy smoking tobaccos, the flowers need not be removed.

After-care of the plants.

There is after this very little necessary. The plants, however, should be most carefully examined once or twice a week, and every insect and weed removed. Water should be supplied freely at intervals of a week, and to prevent the earth losing its humidity too suddenly, straw might be spread over it if the heat of the sun is peculiarly great.

Picking the leaves.

The leaves are of three qualities—the lower, middle, and upper, and the first to ripen are the lower. (To ripen is really to assume a yellow tint and bend down towards the ground). As soon as yellow leaves begin to appear among the lower leaves, they must be picked, In about eight days the middle yield will show signs of ripeness, and should be gathered, and in about eight days more the remainder may be gathered. It can, however, be easily known that the leaves are ripe when they detach from the leaf-stalk with ease. They should be detached with the hand, the leaf being pulled upward.

Care must be taken to have labour available to gather each harvest in at its own time, for over-ripeness is fatal to proper curing.

Curing the leaves.

The only thing to be remembered in curing tobacco is that care must be taken not to allow the tobacco to lose its moisture too suddenly, for thereby it becomes brittle—or too slowly—for then it is in danger of rotting. The rules on this head, which hold good in Europe, are however useless in India.

The curing-houses again may be of any shape, provided only that ventilation is thorough, and that sun-light and damp are equally avoided.

When the leaves have been picked, they are placed in heaps (which must be turned at intervals) to wilt, that is to fade, wither. By being in a heap, they keep their moisture, and though quite dead, do not lose their flexibility.

The leaves are then strung (on string or sticks) in the curing-house: after this they are exposed to the sun: they are then tied in bundles and heaped to induce fermentation. The details of the curing processes cannot be learnt from works on European tobacco cultivation, but may be acquired easily by the study of the *temperature* of this country during every hour of the day and every day of the year, and by a clear knowledge of what is required to be produced. Again, the arrangement of the leaves in the curing-house so as to economise space, utilize ventilation, &c., &c., gives scope for the ingenuity of each cultivator, and cannot be learnt by rules.

One point, however, to remember is that the leaves must not stick together when strung.

Sorting the leaves.

When the leaves are dry without being brittle, dead and discoloured, but still pliant, they are said to be cured and are ready for sorting.

The sorting of the leaves depends of course upon the local market for which the tobacco has been raised, but a safe rule is to keep for cigars all that can be kept for cigars and to use the remainder for tobacco. Snuff, which requires the finest leaves of all, would not in India repay the manufacture. For natives of this country, the tobacco must be strong: for the European market, it must be aromatic: for any market, it must burn easily. It is evident, therefore, that very much depends upon the manure used, as the matters drawn from the ground must materially determine

the strength and combustibility of the produce. A heavy soil, strong manure, and plenty of moisture produce a strong and rank tobacco: by ripening also tobacco gains in nicotine. Sunshine, dry warmth, and a light soil give, on the other hand, mild and aromatic tobaccos. It is from this evident that next to the manure employed, the most important point is the quantity of the moisture, and if the manufacture is for the native market, this should be liberal.

The importance of choice of manure and watering.

Notes by Mr. Robinson.—The great difficulty in curing tobacco is the disposal of midrib which persists in either drying stiff or not drying at all. But why should it not be removed? Not entirely, for then the leaf would be spilt into two, but only on the back of the leaf where the convex and greater part of the midrib projects. The operation, though a delicate one, would become easy to any child after a half hour's practice. The operator would take a leaf in his left hand, holding it between his finger and thumb at the stalk end. About half an inch from the end (the stalk end), he would make an incision in the midrib with the thumb nail of the right hand and turn up an end. He would then take hold of this with the finger and thumb of the right hand, and with an equable force pull off the midrib downwards towards the point of the leaf. As soon as it became very fine and there was a danger of the leaf being torn, he would nip the midrib off with his finger and thumb. By this, the concave or nearly flat surface of the midrib would be left on the upper side of the leaf, while on the back of the leaf the only sign of the midrib would be a narrow *depression* running down the centre of the leaf, where the troublesome midrib had been. The operators (who might easily be children) should be parti-

The midrib: how to dispose of it.

The great care necessary not to handle the leaves.

cularly warned *not to handle the leaf or to make a rent in it.*

Indeed, throughout all the operations of pricking out, planting, hoeing, thinning, sorting, stringing and midrib-scooping, every operator should be warned against touching the leaf except near the stalk end and against tearing it. Care might be guaranteed by grading the wages of the operators according to results.

The sun-flower.

The sun-flower *(Helianthus)* might be advantageously grown among the tobacco—1*st*, for the shade it would give to the larger and coarser tobaccos required; 2*nd*, for the admirable stringing rods (if string itself is not used) which their stems supply; 3*rd*, as they would (if their leaves were ploughed into the ground) give almost the exact vegetable mould which is required by tobacco.

Notes on the Indian Bombycidæ, as at present known to us, by CAPTAIN THOMAS HUTTON, F. G. S., C. M. Z. S., *Corresponding Member of the Agricultural and Horticultural Society of India.*

BOMBYCIDÆ.

1. *Bombyx mori.*—(Lin.)—The largest of the domesticated Chinese Bombyces, originally from China, about North Latitude 32° to 34°. Also in Japan. This has been cultivated in Europe, especially in France and Italy, as well as in Syria, Egypt, Persia, Bokhara, Afghanistan, Cashmere, in one or two localities of the Northern Punjab near the hills, and thrives well at Mussoorie, everywhere feeding upon various species of mulberry and everywhere an annual, only *except* at Mussoorie, where I can obtain two crops. This is the worm that lately failed in France after centuries of do-

mestication. It occurs *nowhere in the low-land Gangetic Provinces*, but its name is assigned, in ignorance, to *all* the under-mentioned species. "Where ignorance is bliss, 'tis folly to be wise," and after all, "what's in a name? a rose by any other name would smell as sweet!"

This species has been introduced into Australia where it is said to thrive well, although Dr. Wallace of Colchester has lately informed me that Australian eggs do not hatch so kindly and regularly in England as English bred eggs; instead of coming forth in a swarm, they appear daily in small quantities only. This I attribute to the high temperature of Australia having acted injuriously upon the constitution which is debilitated.

The best silk of all is produced by this species, and readily sells, with good reeling, at 25 shillings per lb. Mr. Cope sold some at that rate which he produced in the Punjab; and that reared at Mussoorie fetched the same price. A splendid silk is produced by crossing this species upon the smaller monthly worm known in Bengal as the *désee*, but the crossing requires great attention, and the out-turn after all may not be worth the trouble, for unless very closely watched and attended to, the worms will invariably revert to annuals. Silk—golden yellow when in health.

2. *Bombyx textor.*—Hutton.—This species is cultivated sparingly in several parts of India, but its constitution is thoroughly worn-out, and it ought to be sent to a hill climate. At Mussoorie it thrives well, and although like the last, an annual everywhere else, here it yields a second or autumnal crop also. It was originally brought from China, near Nankin, in North Latitude 32°, but is fast fading away from Bengal. It is cultivated in France and Italy and in China, as well as in Bengal, and in those countries generally produces a pure white silk; in Italy there are more white than yellow cocoons, but in France more yellow than white; this is dependent upon climate, as is well shown at Mussoorie

where worms introduced from Bengal produce *white* cocoons for the first crop, but almost all yellow in the second crop. The worm being northern, is impatient of heat and suffers accordingly in constitution, the silk in consequence becoming white, which, as I have elsewhere pointed out, is generally a sign of loss of constitution, not only among silk-worms, but among animals still higher in the scale of nature; the natural colour of the worm of *Bombyx mori* is nearly black-brindle, whereas the worms under domestication are of a sickly creamy white. So, then, the climate of France being more temperate than that of Italy, produces more yellow than white cocoons. The species is often termed the Milanese or Italian stock, and in Bengal is known as the Burra pooloo, because its cocoon is larger than those of the so-called *desee* worms or polyvoltines.

It is cultivated in Assam and, according to Dr. Royle, is there and elsewhere called "*Pat* major," although it is invariably confounded with *B. mori*, than which it is at least an inch smaller, though in other respects closely resembling it. The cocoons are of a different texture with more floss. The silk varies in price from 18 to 22 shillings per lb. Unless it be very soon transferred to the hills, this species will certainly die out; here I *could insure its life* without difficulty.

3. *Bombyx Cræsi.*—Hutton.—This is the largest of the monthly worms, and in Bengal passes under the native name of the Madrassee or Nistry, and is as usual confounded by Europeans with *B. mori*, although the one passes as an annual, and the other as a monthly worm.

The silk is good, of a golden yellow, and the worms thrive best in a temperate climate; in Assam (*apud* Royle) it is known as "*Pat* minor." This species is cultivated in several parts of India, and thrives well at Mussoorie. It is to be particularly remarked, however, that none of the Chinese species, whether annual or monthly, have hitherto succeeded in the North-Western Provinces, Dr. Royle long

since remarking that all the Old Company's Filatures did not extend higher up the country than about 26° of North Latitude, owing to the dry hot nature of the North-Western climates.

4. *Bombyx fortunatus.*—Hutton.—Known to the Bengalees as the *désee* worm, and like the others dignified by Europeans with the name of *B. mori.* Silk—golden yellow, distributed over Bengal and other parts of Southern India; but people know so little of the distinguishing characters of species, that it becomes very difficult to say what species is alluded to in magistrates' reports unless the native name is mentioned. This also is one of the polyvoltines. A sure mark of distinction between the worm of this species and that of any of the others exists in the fact that when near maturity, it becomes of a dull leaden blue color. This species thrives best in the cold weather. It is very small, but yields a good cocoon, although the returns of silk are said to be uncertain; there are no dark worms observable among them. The worm is figured in the second part of my paper "On the Reversion and Restoration of the Silkworm," as published in "The Transactions of the Entomological Society of London"—*(quod vide.)* [*Also in the Journal of the Agricultural and Horticultural Society of India, Vol. XIV. p.* 8.]

5. *Bombyx Sinensis.*—Hutton.—This is known as the "*Sina*" of Bengal, but, like the others, it originally came from China; it is very prolific, and even at Mussoorie goes on yielding crop after crop, up to the middle of December. The cocoons vary in colour, some being white and others yellow, while others even have a beautiful faint greenish hue. These changes clearly show that the health of the worm is becoming impaired. There is a peculiarity about these also which may enable the tyro to distinguish them from any of the others; while all the other species hatch slowly during the morning, from six to twelve o'clock, the *Sina* worms come forth all in the batch, or continue hatching all day and all night.

6. *Bombyx Arracanensis.*—Hutton.—This I have only once been able to procure and the worms died off soon after hatching. The cocoon is said to be larger than those of the Bengal monthlies, but every little beyond the fact of its existence appears to be known, and people are so apathetic in these matters that letters, as a rule, remain unanswered. As the species is supposed to have been introduced from Burmah, it may probably turn out to be the same as that which was lately reported to exist in Burmah. [*See Journal Agricultural and Horticultural Society of India, Vol. II., New Series, p.* 191.]

7. *Bombyx* ———? I have heard of a species which in Central India is said to yield three crops of silk in the year, and that as soon as they are hatched, the worms are placed out upon mulberry trees and left there until they spin the cocoon. Some of the cocoons were kindly sent to me, but were so crushed in transit that they were destroyed; the cocoons were small, but silk good, of the pale colour and something like those of *B. fortunatus.* I wrote for more cocoons and eggs, but my application has been unattended to, although my correspondent promised to assist me. I shall try again.

The following, with the exception of *B. Huttoni,* are little known. Mr. F. Moore wishes to place them in a separate genus under the name of "*Theophila,*" one of his chief characters being the rows of spines on the larvæ; I object, however, to the establishment of this genus, because, in truth, we know little or nothing about them, and as to the spines, two species only are as yet known to possess them; nevertheless, they certainly do not stand properly under the genus *Bombyx,* but we must wait yet awhile in order to ascertain whether all can be included in the same genus.

8. *Bombyx* (Theophila) *Huttoni.*—Westwood.—This is a wild mountain species, feeding on the indigenous mulberry of Simla, Mussoorie, and Almorah. I first discovered it at Simla in 1837, and afterwards in great abundance at Mussoorie. In some years they swarm to such an extent, that

by the end of May, the worms of the first, or spring brood, have thoroughly denuded even large forest trees, not leaving a single leaf. In this predicament they quit the tree in search of another which they generally find near at hand, and which is then soon thickly covered with cocoons spun in the leaves; but if, unfortunately, they fail to find a tree at hand, the whole brood perishes, the most forward worms spinning cocoons among shrubs and grass. The trees thus denuded instead of dying, are in another month once more in full leaf, as if nothing had happened.

It is a strong and hardy species, yielding a beautiful soft, whitish silk, and although the worm is too intractable and wandering to be treated in the usual manner in the house, yet I am by no means sure that it cannot be turned to good account by collecting the cocoons from the trees, as was evidently done in the outset by the Chinese with respect to *Bombyx mori.* For a full report I refer the reader to my paper, Part II., "On the Reversion and Restoration of the Silk-worm," published in the "Transactions of the Entomological Society of London." [*Journal Agricultural and Horticultural Society of India, Vol. XIV. p.* 67.]

9. *Bombyx* (Theophila) *Bengalensis*—Hutton.—If the species discovered some years ago in Bengal by my friend A. Grote, Esq., is correctly figured in my paper No. 2, just alluded to, then that sent to me from Chota Nagpore in 1869, by Mr. King, must be distinct, for it is in all respect, as to shape, colouring, markings, &c., a prefect miniature of *B. Huttoni;* that it is distinct, however, is shown in the smaller size both of larva and imago, as well as in its being a polyvoltine instead of a bivoltine like *B. Huttoni.* In Chota Nagpore the food was the leaf of *Artocarpus Lacoocha,* upon which tree likewise Mr. Grote found his specimens; but as the latter gentleman was in the habit of employing an accurate native delineator of insects, I much doubt any error occurring in the figure kindly supplied by him to me, and therefore am inclined to regard M. King's species as distinct

from Mr. Grote's, and would term the Chota Nagpore insect *Bombyx* (Theophila) *affinis,* (nob.) in reference to the remarkable affinity to *B. Huttoni,* in all its stages.

10. *B. affinis—Hutton.*—When the young worms hatched at Mussoorie, from eggs and cocoons sent from Chota Nagpore, I had no leaves of *Artocarpus* within some miles and was sadly puzzled to feed the worms; I tried, without success, the leaves of wild fig trees, *Ficus venosa, Morus nigra, Morus sinensis, M. multicaulis, M. cucullata, M. serrata* (wild), but all to no purpose, and I had almost made up my mind to lose the species, when it suddenly occurred to me to try the leaves of *M. indica.* With these I succeeded, the young worms riddling the hard, coarse leaf into a perfect sieve in a few minutes. Like *B. Huttoni,* in the two first stages they were dreadfully troublesome, wandering down from the branches and spreading all over the table, but as they grew larger they became more tractable and remained tolerably quiet, eventually spinning their cocoons in the leaf like *B. Huttoni.*

When the moths appeared, there was equal difficulty in getting them to pair, and then even many of them laid no eggs; those that did so, deposited them in batches and then covered them over thickly with the brush or tuft of hair at the end of the abdomen; thus the eggs of *B. Huttoni* are pale straw colour, glued to the trunk or branches of the tree, and quite naked, whereas those of *B. affinis* are of an orange colour and covered with dark hair. This renders it difficult to detect them on the bark, and the covering is probably used as a non-conductor of heat. The eggs of *B. Huttoni* are scattered along the under side of the small branches or over the bark of the trunk, whereas those of *B. affinis* are placed in patches or groups, and none of the eggs that remain without a coating of hair ever produce worms. I obtained four broods, the last being reared on the trees of *M. nigra* in the open air. I am sorry to add that none survived the winter, although the cocoons were kept in a room with a fire; thus, after all my trouble, I lost the species. The silk resem-

bles that of *B. Huttoni,* and is equally good, although from the smaller size of the cocoons there is less of it.

Mr. Grote kindly sent me a specimen of his moth which arrived, as usual by post, quite crushed; the specimen, however, as far as I can remember, was whitish and very much smaller than that of *B. affinis.*

11. *Bombyx* (Theophila) *subnotatus.*—Walker.—Nothing more is known of this species than is contained in Mr. Walker's description of the moth, and that it was procured from Singapore by Mr. R. A. Wallace; neither the larva nor its food is mentioned.—(*Vide Proc. Linn. Soc. Lond. iii. Zool., p.* 188. (1859.)

Whether this be a true Theophila, we cannot tell.

12. *Bombyx* (Theophila) *Sherwilli.*—Moore.—This is closely allied to *B. Huttoni,* but the larva is unknown; all that has been ascertained is that the specimen was obtained from a collection made by the late Major J. L. Sherwill, but whether captured in the plains or at Darjeeling, no one knows. People who have often collected at Darjeeling assure me they never saw the species there; hence I incline to regard it as a lowlander, feeding on *Artoçarpus* perhaps. All that Moore says of it that it is "allied to *B. Huttoni* and differs from it in being somewhat larger, and of a grayer colour, the fore-wing having the apical patch, fuliginous instead of black, and it has only a single transverse discal streak (instead of the two as in *B. Huttoni*). A most prominent character is that the abdomen is tipt with black, as well as having the dark waistband."

13. *Bombyx (Ocinara) religiosæ.*—Helfer.—Although this stands as a Bombyx, the entire description as given by Dr. Helfer applies rather to a species of *Ocinara.* It is called the Joree silk-worm by Helfer, and the Deo-mooga silk-worm by Mr. Hugon. It is said to occur in Assam and Sylhet; but I have failed to elicit information from those localities. Bombyces are far less erratic than the allied genera of *Theophila* and *Ocinara,* and if indigenous in any district,

there they will remain year after year, sometimes in greater sometimes in lesser, numbers; but *Theophila* and *Ocinara* are both inconstant; plentiful one year, absent altogether the next, and with the latter sometimes for two or three years. Hence Grote for four or five years lost sight of *Theophila Benqalensis*, and no one seems to have seen Helfer's *B. religiosæ* since the time of its discovery.

14. *Ocinara Lida.*—Moore.—This species is found at Mussoorie where it feeds upon the leaves of *Ficus venosa*, the larva being very like that of a geometra, and spinning a small white cocoon on the leaf or against a stone beneath the tree. It is too small to be serviceable. I named it after Mr. F. Moore, but he tells me it is the same as the Javanese O. lida. It is a multivoltine. It feeds on the wild fig also.

15. *Ocinara lactea.*—Hutton.—This also occurs at Mussoorie, feeding on *Ficus venosa* and spins a curious little cocoon of a yellow color, within the leaf; over the cocoon is laid a net-work of yellow silk, too small to be of use. It has several broods during the summer. The larva is smooth, whereas that of the preceding is hairy.

16. *Ocinara comma.*—Hutton.—The moth of this is white, with a dark comma-shaped mark on the disc of the upper wings; hence the name. It occurs both in the Doon and at about 5,500 feet of elevation below Mussoorie.

17. *Trilocha varians.*—Moore.—Is a small species found in Canara; and again by Mr. Grote in Calcutta. As a silk-yielder, it is of no value.

For further remarks on these species, consult the second part of my paper "On the Reversion and Restoration of the Silkworm."

18. *Cricula trifenestrata.*—This handsome and curious species is found in various parts of India, sometimes in such numbers in the larva state as to become a prefectly destructive pest; it denudes the mango trees of every leaf, destroys the foliage of the cashew-nut, and is even said to attack the tea plants. It occurs in Burmah, Assam, Moulmein, and Chota Nagpore

in Central India. The cocoons are formed in clusters, so closely interwoven, that they cannot be separated for reeling, which, indeed, their very texture prohibits; they are therefore carded, but are not much used; the cocoons are very irritating, from a number of minute bristly hairs from the caterpillars. I am inclined to think there are two species now standing under this name: as some cocoons are very much reticulated, while those from other localities are far more closely-woven and scarcely reticulated at all. This will never prove productive as a silk-yielder, unless the cocoons can be reduced to a gummy pulp, and used for some other purposes.

19. *Antheræa paphia.*—Linn.—This handsome species is distributed all over India from Burmah to Bombay; but it has to be observed that there are in this wide range several distinct species included under the name. To separate these effectually must be the work of time, and until it is done, there can no really good Tusseh silk be produced. That several of these species are capable of producing a very valuable article of commerce is an undoubted fact, and from its cheapness and durability it would be a boon to that class of the British population which cannot afford to indulge in expensive silks. There is a stupid outcry against Tusseh silk now raised at home by some of the would-be-knowing ones, who are quite ignorant of the fact that they are not sitting in judgment upon a genuine article, but upon one compounded by the natives by the mixture of the silks of three, if not four, distinct species whose fibres are of different thickness. Take the silk of any one un-crossed species and reel it as carefully as is done with the produce of the Chinese Bombyces, and these cavilling quidnuncs who do not know one from another, would soon sing to a different tune.

At present the native method is this: At the season when the cocoons have been formed, the jungles swarm with them, and men sally forth to pluck them from the trees. These jungles, however, contain several distinct species, a hing of which the natives are profoundly ignorant; these

cocoons are all promiscuously huddled together, placed in hackeries, and carted off to the dealers. They are then sorted according to size, thickness, colour, &c., and named accordingly as a kind of trade mark, but without any reference to species. The cocoons selected for reeling are treated in the roughest manner and all kinds spun off together; those that are kept for breeding are allowed to eat out of the cocoon, as it is termed, and to interbreed, still without reference to species; and as this has been going on from time immemorial, of course the species have become blended into a most confusing cross-breed. Hence it results that if a dozen cocoons are taken at random, no two moths will probably resemble each other.

This system of crossing is not confined to the Tusseh group. I have detected it more than once in what were termed Japan worms imported direct from that island; indeed, I have not only detected the cross, but I have succeeded in separating the species which composed it; in one instance, I found *Bombyx mori* crossed with *B. Sinensis*, and on another occasion *B. textor* and *B. Sinensis*. In the case of domesticated species there is no great difficulty to contend with, but with regard to the wild species the thing is very different, and, in short, I can scarcely yet say that I see my way at all clearly. In the Dehra Dhoon and extending up the hill side to about 4,500 feet, or perhaps more, we have two species of Tusseh, one of which is also found in Central India; what the other is, I am not yet prepared to say. Here, however, we have no artificial crossing, so that our species may be regarded as types. The difficulty is to get the sexes of two moths showing marks of relationship to come forth at the same time, so as to obtain a brood and compare the larvæ with others. To trust to the reports of the unscientific would only add to the confusion; a gentleman residing in one of these silk districts kindly furnished me with cocoons of what he declared to be distinct species, and furnished me with voluminous notes, but neither the one nor the other furnish the slightest data upon

which I can work or depend; that a cross exists I can see, but my correspondent is not able to enter into my views and wishes. To visit the jungles myself at the season when the worms appear is out of the question, and the cocoons afford no information. Nevertheless, I shall continue to collect hints from all who may be kind enough to give them.

20. *Antheræa nebulosa.*—Hutton.—This is one of the species that has been crossed upon *A. Paphia*, and it seems to be not uncommon throughout Central India. It is a well marked species, and as specimens have been sent to England, we shall soon hear what the opinion is, provided the moths arrive in safety. The silk would probably rival that of *A. Paphia.*

21. *Antheræa* ———?—I refrain from naming this until I can obtain more specimens; it is found in Central India and in Delhra Dhoon. It is quite distinct from either of the foregoing.

22. *Antheræa Pernyi.*—Guér. Mén.—This species was discovered in Mantchouria to the north of China, where it feeds on the oak. According to Mr. Atkinson, of the Educational Department, Calcutta, he has captured two specimens of what he declares to be this species, at Darjeeling; these flew to a light placed out in the evening, but nothing further was ascertained. The great difference between the climates of Darjeeling and Mantchouria calls special attention to this discovery, and leads one to wonder that the species has not been detected at Mussoorie and Simla, both farther to the north. It would be as well if Mr. Atkinson would give his attention to the subject, and enable us to bring it under cultivation.

23. *Antheræa Yamamäi.*—Guér. Mén.—This is a Japan species and is well thought of both in England and in France where great efforts have been made to introduce it, but as yet with very indifferent success. Last year I received through the kind offices of Dr. Wallace an ounce of these eggs direct from Japan, and found them to thrive admirably on our hill oak; unfortunately my means were not adequate

to the undertaking, as gauze covers were found to be indispensable in order to ward off the attacks of insects, such as bugs, the larvæ of coccinellæ, spiders, &c., and as some of the young trees were about six feet in height, the expense was greater than I cared to undertake, as I was certain of no reward. However, the experiment was suddenly cut short in one night when the worms were in the fourth stage, by the incursion from below of a swarm of large black ants which carried off every one, so that like Lord Ullin, "I was left lamenting." The species however is well worth another trial if only for my own amusement.

24. *Antheræa Assama.*—This is the Mooga or Moongah worm of Assam which produces a very excellent silk, which if well reeled by skilful hands, instead of being carded, would be extremely valuable. I have found this species in the Dehra Doon feeding upon a tree known to the natives as "*Kirkee,*" but I only procured one male and have not since seen another. I am searching for it, as there must be more than one.

25. *Antheræa Perrottetti.*—Guér. Mén.—Said to occur at Pondicherry, but although I long ago applied to the late Mr. Perrottet, he could not procure any specimen of it, although he sent *Antheræa paphia* (vera) and Actias Selene. I am half inclined to regard it as a mere variety of *A. Paphia.*

26. *Antheræa Helferi.*—Is found at Darjeeling, cocoon resembling that of the common Tusseh; but no one seems inclined to do more in those regions than collect the moths.

27. *Antheræa Frithi.*—Is another Darjeeling species, of which we know no more than of the last. At that station, where species are abundant, no one ever does more than collect the imago.

28. *Antheræa Roylei*—Moore.—Is common at Simla, Mussoorie, Almorah, and, I think, Darjeeling. It feeds upon the common hill oak, spinning a large but thin cocoon between three or four leaves. I found it at Simla in the winter of 1836 by following a flock of tomtits, one of which,

after a time, began tapping so loudly that I hastened to the spot and found the little fellow hard at work on the outer cocoon from which I drove him off and pocketed the prize. The outer coating is very strong, and I do not think it could be reeled; but within this case is the true cocoon, of an oval form and yielding a good silk. The worms are easily reared, and sometimes give two or three crops, but this is when treated in the house.

The males will couple with *Antheræa Paphia*, but the produce never comes to anything.

29. *Antheræa* ——?—This is a species occurring near Bombay and discovered by the Messrs. Robertson, of the Civil Service, who regard it as allied to *A. Yamamai* of Japan. They have very kindly promised to send me cocoons as soon as procurable. From the rough sketch of the cocoon which Mr. E. P. Robertson sent me, it certainly appears to differ from *A. Paphia*, though I do not think it can possibly be *A. Yamamai*.

30. *Antheræa* ——?—Nothing is known of this species, except that I possess a well formed (probably male) cocoon of about the size of one of the *Bombyx mori*; the peculiarity exists in there being no vestige of a pedicle or safety rope, the cocoon being equally perfect at both ends. Unfortunately, during repeated illnesses, the label has been lost, and I have not the least recollection of where it came from or who sent it, although I incline to think it came from Madras through the kind offices of Mr. A. H. Blechynden. I am particularly anxious to obtain living specimens of this which is not only an undescribed species, but promises to be a valuable silk-yielder.

These remarks will serve to show how much scientific work yet remains to be done in this single genus of *Antheræa*.

31. *Attacus Atlas.*—Linn.—This the largest of the real silk spinners. Is common at 5,500 feet at Mussoorie and in the Dehra Doon; it is found also in some of the deep warm glens of the outer hills. It is also common at Almorah

where the larva feeds almost exclusively upon the "*Kilmorah*" bush or *Berberis Asiatica*; while at Mussoorie it will not touch that plant but feeds exclusively upon the large milky leaves of *Falconeria insignis*. The worm is perhaps more easily reared than any other of the wild Bombycidæ, producing a very large and well-stuffed cocoon of a grey colour and somewhat difficult to unwind; a strong ley of potash appears to be the best solvent. The species is also abundant in Cachar, Sylhet, and is found also at Akyab, in Arracan, as well as in China.

32. *Attacus Edwardsi.*—This species was discovered at Darjeeling and is much darker in colour than the other, and rather smaller in size, but nothing seems to be known of its food and silk.

33. *Attacus Cynthia.*—Abundant at Mussoorie, feeding on various wild plants; common in China where it feeds on *Ailanthus glandulosa*; found in Assam, Cachar, Saugor. Although it is commonly reported to be under cultivation in different places (*vide* Colonel Agnew's Assam Report), yet such is not the case, the *Attacus ricini* being in India invariably mistaken for it. Indeed until a few years ago, when I pointed out the fact, *Attacus Cynthia* was not known to occur in India, the other species passing under that name, as the silk-worms did under that of *B. mori*. *Attacus Cynthia* has been imported into France and England and reared out in the open air on trees of *Ailanthus glandulosa*; it has likewise succeeded to some extent in Australia, and I believe they have it also at the Cape of Good Hope. There are difficulties attending the reeling of the silk as there is with all the *Attaci*, but nevertheless the French have succeeded in turning out some very good silk pieces. In England it is not quite so highly thought of as it once was. In Australia Mr. C. Brady has produced silk from it.

34. *Attacus Ricini.*—This is the worm that produces the silk known to the natives as the Arrindy silk; it is easily reared and feeds on the castor oil plant, *Ricinus communis*:

The silk is obtained by carding. The chief of cultivation are Assam, Rungpore, and Dinagepore, in Eastern Bengal, *not at Dinapore,* as stated in one of Dr. Bennett's reports. It is also cultivated in smaller quantities in other places. The Mekirs to the eastward possess a very fine kind with white silk. *Attacus ricini* thrives well at Mussoorie, and has been introduced into France, Algeria, Malta, and other places.

35. *Attacus Guerini*—Moore.—Is known only from a few specimens of the moth in some museum in England, and I am induced to regard it as no more than an ill-fed specimen of *A. Ricini.* I have failed to procure it from any part of the country, though I have seen an approach to it in ill-fed specimens of the former in my own trays. This underfeeding, or semi-starvation is well exemplified in some very Lilliputian specimens of *Actias Selene,* received from a gentleman who reared it at Serampore, near Calcutta, where he only supplied the worm with food *twice a day;* the moths are only a quarter of the natural size.

36. *Actias Selene.*—Very common in a wild state at Mussoorie, where it feeds on the wild cherry, wild pear, walnut, *Cedrela paniculata, Coriaria Nipalensis,* and several other forest trees and shrubs. It occurs also at Almorah, Darjeeling, Assam, Cachar, Saugor, and at Serampore, near Calcutta. Mr. C. Turnbull failed to reel silk from the cocoons sent down from this, but it has been reeled, though there is not much of it.

37. *Actias Mænas.*—Doubleday—Occurs at Darjeeling and is a very large species, but nothing has been recorded of its habits, food, or produce.

38. *Actias Leto.*—Is another Darjeeling species, the economy of which has yet to be ascertained.

39. *Saturnia pyretorum.*—Occurs at Darjeeling and Cachar, but nothing more is known of it.

40. *Saturnia Grotei.*—Has been found at Darjeeling, and one or two specimens have been captured at Mussoorie, but collectors of moths make no inquiries as to economy, and

for all practical purposes the species might as well remain unknown. I am inclined to think that the larva feeds on the wild pear tree (*Pyrus Kytul ?)*

41. *Saturnia Lindia.*—Moore.—Of this nothing more is known than that it occurred in a collection made by the late Captain James Lind Sherwill, and is supposed to be from Darjeeling or its neigbourhood. It is allied to *Saturnia Grotei.*

42. *Saturnia Cidosa.*—Moore.—From Captain J. L. Sherwill's collection also, and from North-Eastern India, but we have no information regarding it. From its being closely allied to *Saturnia pyretorum,* I should be inclined to suppose it an inhabitant of Darjeeling or Cachar.

43. *Neoris Huttoni.*—Moore.—Found by myself at Mussoorie at about 6,500 feet of elevation, feeding on the wild pear tree. The larvæ are to be found in April. The cocoon is an open net-work, and would produce no silk.

44. *Caligula Simla*—Occurs at Simla, Mussoorie, and in Kumaon, feeding on the walnut, *Salix Babylonica,* wild pear tree, &c., but the cocoon is a mere coarse open net-work through which the pupa is visible, and yields no silk.

45. *Caligula Thibeta*—Occurs at Mussoorie, where I have taken it on *Andromeda ovalifolia,* wild pear, and common quince. It occurs also in Kumaon, but the specific name is a misnomer, the insect never approaching Thibet. Specimens were taken out of a collection made in Kumaon, and because the collector travelled into Thibet it was ridiculously enough called a Thibetan collection, and the species named accordingly. The cocoon is a coarse open net-work through which the larva is visible, but there is no available silk.

46. *Loepa Katinka.*—West.—A very beautiful yellow moth discovered originally in Assam, occurring also according to my ideas, at Mussoorie. Mr. Moore, however, considers mine as distinct. I am not quite satisfied that the cocoon will not yield silk, but there is very little of it.

47. *Loepa Sivalica.*—Hutton.—Closely allied to the last, and found at Mussoorie at about 5,500 feet and lower.

It will probably yield a small quantity of silk.

48. *Loepa Miranda.*—Atkinson.—Found by him at Darjeeling; a good and handsome species, but nothing more is recorded of it.

49. *Loepa Sikkimensis.*—Atkinson.—A very beautiful species found by Mr. Atkinson at Darjeeling. It may be known from the others, by the smaller size, and by the wings being clouded with maroon. Of its economy, nothing is known.

Three or four other species of this family occur in Darjeeling and Sylhet, but beyond their existence, nothing is recorded.

Those species which like *Actias selene* and *Antheræa paphia* weave strong compact cocoons perfectly closed at both ends, are furnished on each shoulder with a hard wing spur for the purpose of separating the fibres when the moth is ready to come forth; it may be heard grating against the silk and the point may often be seen protruding. It is common to the genera *Actias* and *Antheræa,* and was discovered by myself.

In *Attacus, Neoris,* and *Loepa,* the upper end of the cocoon is left open, the fibres pointing forward closely arranged, like the fine wires of a mouse-trap. No spine is needed in these *genera.*

In *Bombyx* and others, although the cocoons are entire, the silk is loosely woven, and the fibres being moistened by an acid from the mouth, are then easily separated by the claws on the fore-feet of the moths.

This is about the state and extent of our knowledge of the *Bombycidæ* of India; that there are many other species yet to be discovered, no naturalist will think of denying. Nature is the book through which the Almighty teaches man to look from earth to heaven, and as His works and knowledge are boundless, so has this beautifully illustrated book no end.

MUSSOORIE;
The 26th July, 1871.

Correspondence and Selections.

Utilization of the stalks of the Cotton Plant.—(Communicated by Dr. R. F. Thompson, *Civil Surgeon, to the Magistrate of Hooghly.)*

I have the honor to bring to your notice a new branch of industry that may be opened to India, which has hitherto remained unknown, and of material importance to mercantile enterprize, I therefore trust it will be deemed of sufficient interest to warrant my troubling you with this communication.

2.—It is now some years ago I brought to the notice of the Agricultural Society of India, through its President, the value and quantity of the fibre prepared from the stalks of the cotton plant, obtainable by the crude and simple process used by the natives themselves in the manufacture of Jute, and not needing costly machinery for its preparation.

3.—As I have been able to collect some cotton stalks, I have taken up the matter once more.

4.—I have now the honor to forward for your inspection specimens of the fibre and gunny cloth made in the Jail. To my mind the cloth, in its texture and durability, is equal to the best cloth manufactured from fine jute, obtainable at the bazar from the Jail manufactures at six rupees per maund.

5.—I append herewith an extract from my letter to Mr. A. Grote, late President of the Agricultural and Horticultural Society of India:—

" 'You are aware that I have been trying to secure for you 'a quantity of *Gossypium* fibre. I have now been promised some 'from two or three parties. I have the pleasure to enclose a 'small sample of this, prepared badly but sufficient to show its 'quality. I know that you are and have been for years greatly 'interested in the new productions of India, and therefore I make 'no hesitation in laying this matter, of no little moment, before 'you. At Dharwar, in the Bombay Presidency, no less than '3,78,000 acres of land is under cultivation at one time for cotton 'alone. I find that after the cotton is collected, the shrub, which 'is annually destroyed, yields a good serviceable fibre, sufficiently 'strong to pack that very cotton in. By throwing it away there

'is an annual loss of Rs. 22,68,000 at the very lowest calcula-
'tion, *viz.*:—

3,78,000 acres under cultivation.
3

11,34,000 beegahs.
Yield 2 maunds to each beegah.

Total 22,68,000 maunds.

'Each beegah will yield more than two maunds; value this at the 'lowest calculation—one rupee per maund, the loss is 22 lakhs 'and sixty-eight thousand rupees. The shrub in its manufacture 'wants steeping."

6.—I believe the cotton stalks are burnt at the end of the season for manuring the soil. It will not interfere in securing that object after removing the fibre, as the sticks can still be used as fuel. To meet the expense of extracting the fibre, a deduction of one and-a-half-lakh of rupees may be put aside for that purpose, leaving still an immense sum to the credit of the cultivators.

7.—Since my letter to the President, the cultivation of cotton in India has increased tenfold, and immense sums are actually wasted in not utilizing the fibre.

8.—The fibre when cleaned has a fine glossy appearance, and I have no hesitation in believing it will readily find favor in Manchester, if properly introduced to the notice of the manufacturers; inasmuch as many valuable fabrics can be manufactured from the fibre.

9.—My object in addressing you on the subject is, that you will be good enough to submit this communication, with its accompaniments, to the Commissioner of the Division, in order, if he thinks the subject is of any value, to draw the attention of His Honor the Lieutenant-Governor of Bengal, and the Chambers of Commerce of the different Presidencies, to it. If the latter body deem it of any mercantile value, I shall be prepared to enter more fully into the nature and mode of obtaining the best fibre from this plant. In the meantime, as I conceive the matter is of some interest, you will pardon me if I urge your serious and earnest attention to the subject.

The Secretary mentioned that this subject was first brought to the Society's notice by Dr. Thompson in April 1863 (see Proceedings for that month), when he was requested to forward a larger sample of this *Gossypium* fibre and further information as to the yield per beegah and cost of production; and a second time, through Mr. Grote, (as quoted in his letter) in September 1867. The question of utilizing this fibre had never, that he was

aware of, been previously submitted to this Society, though it had attracted some little attention in the United States, as a reference to the Patent Office Reports for 1854 and 1859, in the Agricultural Department, would show. The following extract of a paper by Mr. G. C. Shaeffer, addressed to the Commissioner of Patents, bears especially on this point:—

"Before I conclude, another matter of some interest in the same connection may be noticed; it is well known that in all parts of the world the bast liber or inner bark of the malvaceous plants yields a useful fibre of various degrees of fineness. There was no reason why this should not be true of the cotton plant, and it seemed rather remarkable that no notice of such an use of its bark had ever been made.

"At the close of the season, I made this matter the special subject of examination. I found the cells forming the fibre rather coarse, much more so than those of the species of *Hibiscus* and kindred plants, which, in the Sandwich Islands, yield a very fine and durable fibre; still the cells of the cotton bark fibre may not always be as coarse as in the plants examined by me.

"There is, however, another bar to their being extensively used; the wood of the cotton plant is tolerably hard, and the separation of its fibres by mechanical means is not so easy as in the case of other fibrous plants, such as hemp, in which the wood-cells are short, relatively small in number, and easily separable from each other, and from the bast cells.

"Again. If the plant is left to mature for the purpose of getting the cotton, the bark fibre becomes, by prolonged exposure, so much stained that it cannot be easily bleached, or, at least, not without injury to its strength.

"Still in the present scarcity of paper-making material, it may be well to look to the bark of the cotton plant as a partial supply for the commoner kinds of paper. Fermentation, or any of the known methods of separating the wood, might be employed; except, where labor is very cheap, stripping by hand could hardly be thought of as a profitable method."

Read the following report from a section of the Fibre Committee on Dr. Thompson's samples:—

Mr H. Knowles.—I have examined the fibre from the cotton stalks and consider it equal to a middling quality of Jute. It has neither the color nor the strength of *fine* Jute. The gunny made from it is similar to a cloth that could be made out of Jute, valued to-day (18th November) at about Rs. 4-8 per maund.

Mr. S. H. Robinson.—I would rank this fibre with very low quality Jute, as it seems very deficient in strength and color. Still it should be useful for some of the purposes inferior Jute is put to.

Resolved—That a copy of the above report be furnished to the Commissioner of Burdwan.

Wild silk-yielder in the Akyab District.—(Communicated by W. DECOURCY IRELAND, ESQ., *Deputy Commissioner, in a letter dated 12th December,* 1870.)

I send by post to your address a parcel containing a specimen in spirits, of a silk-worm lately discovered in the western portion of this district, in the vicinity of the Mayoo River; as also some cocoons, and some specimens of the leaves of a plant on which the worms were found feeding. [*Mœsa ramentacea*, a Myrsinaceous shrub not unfrequent in the forests of Eastern Bengal, and throughout the Malayan peninsula].

As far as I can ascertain at present, the worm is of the species found in Assam, and described as "Phalæna Cynthia:" but I shall feel greatly obliged if you will identify the species and let me know what it is.

The manager of the Poundaubgun tea-estate, who discovered the silk-worm in a wild state, has not given very much information about it. He however states that the tree on which it was found was a low shrub, the name of which he could not ascertain. I have been unable to discover any name for the shrub from the Bengalees who live in the vicinity of the place where the worm was discovered.

The cocoons were found on the tree in the jungle. The cocoons do not appear to have been gathered by the people, or turned to any use. The silk-worm was known to them, not for its quality as such, but merely as an article of food. The silk-worm appears to have been considered—at least by some of the Hill tribes in the neighbourhood,—as rather a delicacy.

Two of the worms reached me alive. One of them fed voraciously on the leaves of the plant on which it was found: but refused to touch the leaves of the castor oil tree (Palma Christi), which are eagerly eaten by some silk-worms in Burmah.

Mulberry leaves were not available, and I am therefore unable to state whether the worm would eat them. As far as known there are not any mulberry trees in the vicinity of the place where the silk-worms were found.

Extract of letter from CAPTAIN THOS. HUTTON, *Mussooree.*

Your caterpillar and the two cocoons from Mr. Ireland, Deputy Commissioner, Akyab, came safe to hand. They belong neither to *Attacus Cynthia*, nor to *Attacus Ricini*, but to a species of Atlas of which we have two, one the common *Attacus atlas* found here at Cachar and elsewhere, and the other at Darjeeling known as *Attacus Edwardsi.* The worms of the first feed on *Berberis Asiatica*, and on *Falconeria insignis* and one or two other forest trees; the food of the other appears as yet to be unknown. To which of these species your specimens belong cannot be fully determined until the moths come out next sum-

mer, but from the small size of the cocoon as compared with that of *Attacus atlas*, from the colour of the silk, and from a certain indefinable something about the larva, I incline to the opinion that the species is *Attacus Edwardsi*, or a new species! The cocoons appear to me to be identical with those sent lately from Cachar by Mr. C. Brownlow, which I also suspect to be *Attacus Edwardsi*; unless, indeed, the small size is to be attributed to insufficient feeding in the house, although the cocoons seem so well formed, and so full of silk, that this seems improbable. The moment the moth appears I will let you know the species.

Experimental culture of Carolina Paddy at Deebrooghur, Assam.—Communicated By Richard Rowe, Esq., *dated 23rd January*, 1871.

I have much pleasure in sending you the report on Carolina paddy asked for in your letter of the 30th November. I was not able to do so at the time I received your letter as the paddy was still in the ground and was not cut and gathered till the end of December.

I received the seed late in June, about 20 seers was put into a nursery early in July and transplanted in August, over about ½ a beegah of land, it came on exceedingly well, being much stronger in the stalk and growing more luxuriantly than the Assam paddy along side of it, which had been put out a month to 6 weeks before, some which was transplanted at the same time failed entirely.

The yield was about 5½ maunds, at the rate of 11 maunds per beegah, the villagers here say they get from 5 to 7 maunds per beegah of their own paddy. This year the yield was a little over 5. They say if the Carolina paddy had been sown earlier it would have given a still larger yield (this may or may not be correct.) Those who have eaten it approve of its quality and confess that it is better than their own. From the success of this sowing, I am of opinion that the substitution of Carolina paddy for the Assam descriptions would be of great benefit to cultivators, the yield being larger and the quality superior. I have kept nearly all the seed for sowing next season.

Experimental culture of Carolina Paddy in the Midnapore District. (Extract of a letter from the Superintendent, Canal Revenue, Bengal, to the Secretary to the Government of Bengal, Department Public Works, Irrigation,)

I have the honor to bring to your notice the great favor which in the lands commanded by Irrigation Canals, the experiments with Carolina paddy have met with from the zemindars and cultivators.

2. A small amount of Carolina paddy was obtained from the Collectors and distributed some two years ago. It is so highly approved of, that the yield in both years has been almost entirely kept for seed, and thus the area grown with this rice has each year increased.

3. The excellence of the rice, the largeness of the yield as compared with the ordinary kinds of rice falling under the denomination of Bealee or Aous, and the short time it has to remain on the ground, thus affording ample time for the cultivation of another crop within the year on the same land, after the reaping of the crop, have been the chief causes of the favor it has met with.

4. It is sown on the higher lands near the distributaries and is generally reaped in October, having been sown in June or July. The lands are then prepared for cotton or other crops, which are gathered in or before May, when the ground is again tilled for the rice crop. Canal water, if available, is always taken for the irrigation of this crop.

5. My immediate object in addressing you on this subject is to ask you to be good enough to endeavour to obtain in Calcutta from the Agricultural and Horticultural Society or from other sources, a considerable supply of selected Carolina seed paddy, to be forwarded to me, for sale at cost price, to the irrigating zemindars and cultivators. They would, I am confident, eagerly avail themselves of it and a considerable benefit would thus be conferred on them at no cost to Government.

Exotic Tobacco cultivation at Dharwar.—(Communicated by E. P. ROBERTSON, ESQ., *Magistrate and Collector of Dharwar, in a letter dated* 20*th December*, 1870).

In the *Agricultural Gazette of India*, October 15th, 1870, page 86, there is a notice of exotic tobacco cultivation in Burdwan.

I have for two years cultivated exotic tobaccos, and have been making experiments in the hope of discovering some method adapted to the climate of this country for curing tobacco.

I am convinced that the system of tobacco curing ordinarily in use in America and Cuba is of no use whatever in this country. Here we have the dry air to contend against. The difficulty is to get the mid-rib to dry without making the tobacco quite brittle. If the tobacco is packed in bands to ferment with the mid-rib not quite dry, no care in the world will prevent the tobacco becoming mouldy and bad. If the mid-rib is allowed to become quite dry, the tobacco becomes quite brittle and is condemned as useless. It is not useless, however. Tobacco cannot be properly cured in this country till the mid-rib is quite dry.

I have the pleasure to forward you two cases, one containing leaf tobacco of the varieties marginally noted. This leaf tobacco when packed was perfectly soft and pliant, and, if it has been sufficiently closely packed, I hope will reach you in good condition.

Havanna from Government Imported seed.
Shiraz.
Ohio.
Viginian.
Himalayan.

The other case contains cheroots made up of these different varieties of tobacco. I had very great difficulty in securing the services of any one able to make cheroots. The old man who made up the cheroots now sent had not made any for many years, consequently his hand was out and most of the cheroots are far too tightly rolled. The tobacco sent should, however, not be condemned, because the cheroots are not well made. The Shiraz has I think, an exceedingly fine aromatic flavour. The Himalayan no flavour whatever, while the Havannas, Virginian and Ohio are to my taste exceedingly strong.

In fact all these tobaccos excepting the Himalayan, are stronger than they should be, and this I attribute to my having cut the plants as soon as one or two leaves appeared somewhat ripe, and before the whole of the plant had become properly ripe.

This year I have now gathered a very large crop of good tobacco, and as an experiment have not cut it in plants, but have had it plucked leaf by leaf as they become ripe. The consequence is, that the tobacco, while having its full aroma, has lost the harsh strong taste of the Havanna, Ohio and Virginian now sent. I hope this time next year to be able to forward you a specimen of this year's tobaccos, and curing, that will, I think, show some slight advance.

The plan I have adopted is to pluck the leaves after 8 o'clock A. M., but only those that have become ripe. These I then put in heaps in a room well ventilated. These heaps are watched and the tobacco turned to prevent its heating too much and rotting. In two or three days the tobacco obtains a good colour. The leaves are then strung together in bands of from 10 to 14 leaves. This is done with a strong needle and twine. The bands are then hung up in a drying room close to one another. By proper arrangement of ropes from the ceiling and cross ropes a very large quantity can be hung in a room. The tobacco is left hanging till the mid-rib is quite dry. The bands are then taken down and the tobacco is put by in large boxes or baskets (the latter must be lined with paper to prevent mould, which attacks bamboo as soon as there is rain). The tobacco is left in these baskets till the next monsoon. As soon as the air is damp from the rain the tobacco is exposed to the damp air, and as soon as it becomes soft and pliable (but not damp) it is smoothed out into bands, and packed in the boxes or baskets again in heaps not more than one and half feet high to ferment. This it does most quickly. At the end of from six to eight weeks the tobacco is well cured and can be made into cigars or packed for exportation. The tobacco

while in heaps and fermenting should be examined to prevent its over-fermention.

If only ordinary care is taken the process is simple enough. The tobacco now sent is not as well cured as it might be, owing to much of the tobacco having been plucked when not sufficiently ripe. The tobacco, however, is large and fine, especially the Havanna and Shiraz. The soil in which the tobacco was grown was a poor red soil. I have distributed considerable quantities of seed in this district, and the cultivators are much pleased with it. They prefer the Havanna to all the other descriptions. The Shiraz, they state, grows too tall, and the leaves, unless the plant is well headed down, are apt to become too fine. I shall esteem it a favor if you will forward me the Society's opinion of the tobacco sent.

Tobacco raised at Julpigoree.—(Communicated by Colonel J. C. Haughton, *dated 15th February,* 1871.*)*

I place at the Society's disposal specimens of tobacco from an annual show held at Cooch Behar. I regret to say that as yet the show has failed to elicit even the best samples of tobacco or to encourage attention to quality. The actual cultivators are generally afraid to come forward, and when they do so out of deference to their superiors, send up inferior samples, having a vague idea that the ultimate object in view is taxation of the article. I shall be glad to receive a report on the samples, and will feel obliged by your causing a small box, say 50 or 100 of each, to be made up for me and duly labelled, the cost of which I will defray. I may mention that I had some of the Cooch Behar tobacco made into cheroots in 1864, these were consumed during the Bootea Campaign in 1865 and were pronounced "very good."

You sent me some tobacco seed the year before last among the flower seeds from Paris. It was sown by the gardener as such in the flower seed in my garden. As under these unfavorable circumstances it promised well, I determined to try and cultivate it. Accordingly at the proper season a small patch was planted out, care having been taken to manure the ground, it has come up well and the crop has been cut. The leaves are some of them the largest I have ever seen. I am from three weeks to six ahead of the country cultivators and have escaped the risk of hail storms which often destroy the crop. When cured I shall send you a sample. The flower differs from that of any variety known to me in being of deep red (lake?) color. I am unable to say whether it is any one of the varieties mentioned by Voigt as he merely calls those having any tinge of red "rose colored." One plant just brought to me by the gardener for instructions measures four feet. My neighbours, who last year refused my onion seed from superstitious motives, have, observing the vigour of the tobacco, begged the unused seedlings to plant out. . . . .

Report on samples of Tobacco, submitted to the Agricultural and Horticultural Society, by E. P. ROBERTSON, ESQ., C. S., *Collector of Dharwar, and* COLONEL J. C. HAUGHTON, *Julpigoree.*

The specimens of tobacco submitted by Mr. Robertson are admirably prepared as far as the preservation of the leaves is concerned, but we are sorry to say that we cannot pronounce it well cured. The red coloring matter contained in the tobacco has been highly developed by the process of dessication at the expense of the alcoholoid liquid which constitutes the principal qualities of the tobacco. In fact, the nicotine does not exist in the samples submitted to our Society. To render it an article of some value in the European market, it would be necessary to cure the tobacco by means of acetic acid and a solution of chloride of sodium.

The leaves with which the cheroots have been made, have been evidently submitted to a certain process of fermentation by the manufacturer, but they are still deficient in *nicotine*, owing to the imperfect development of ammonia which is required in the tobacco to destroy the acid or acrid principle which neutralises the *nicotine*. The tobacco is otherwise well grown and of a very fine quality, the Virginia more especially, which would fetch about Rs. 18 to 20 per maund if the nicotine was more developed.

We shall observe, in conclusion, that the tobacco in its present state could not stand a sea voyage to Europe, as it would be destroyed by insects during the passage.

The samples of tobacco submitted by Colonel Haughton, contain some very fine specimens of tobacco—amongst other, Nos. 3 to 6. But we are sorry to say that the tobacco is neither well dried nor well cured, and in its present condition it is quite unfit for exportation for the European markets. The bundles being too large have retained an immense amount of dampness, which has caused the development of insects, which would not fail to destroy the whole of the leaves during the voyage. The leaves contained in the packages numbered 1, 2, 4, 5, are evidently from the Havanah stock, but degenerated by improper cultivation; 3 and 6 are of a finer kind, and seem to belong to a different variety, perhaps Virginia;—very fine cigars could be manufactured with that tobacco. That quality seems to be more suitable for European consumption than any other sample submitted, and is worth 10 or 12 rupees a maund.

CH. FABRE TONNERRE,
ED. VAN CUTSEM.

Calcutta, 18th May, 1871.

P. S.—As the process of curing tobacco described by Mr. Robertson is a tedious one, and quite unsuited to the cli-

mate of Bengal, I intend to submit at the next Meeting of the Society a short memo. on the best mode of curing tobacco in India.

CH. FABRE TONNERRE.

Remarks by DR. TONNERRE *on* COLONEL HAUGHTON'S *letter.*

The tobacco alluded to in the letter of Colonel Haughton is the *Nicotiana gigantea*, or *latissima*, which is largely cultivated in the gardens in Europe as an ornamental plant. It is a variety of Cape tobacco, *Nicotiana Capensis.* It is not used in Europe for domestic purposes, as it has been found wanting in nicotine. It would be worth ascertaining if the active principle of the tobacco is more developed in this country under the action of a warmer climate. So I would suggest that the tobacco cultivated by Colonel Haughton in his garden should be carefully gathered and well cured. I have a few plants of the same tobacco which I obtained from the Countess of Mayo. I have transplanted them upon the rich soil of the lands reclaimed by the sweepings of the town at the Salt Water Lakes, where they thrive admirably well. I shall give in due time to the Society an account of the cultivation of this kind of tobacco and the results obtained.

CH. FABRE TONNERRE.

Reply from MR. E. P. ROBERTSON, *to the Committee's Report on his samples of Tobacco.*

I have to thank you for the printed papers containing the report on the tobacco sent by me.

It appears to me that there must be some mistake as to the tobacco containing little or no nicotine. Very many of my friends have tried the tobacco and pronounce it to be good, with however the fault of being exceedingly strong. Now the strength of tobacco comes from its nicotine, and if the specimens I sent contain no nicotine whence the strength?

I believe that nothing destroys tobacco so much as moistening it. How then is acetic acid and chloride of sodium to be used in the curing.

If the process of desiccation had been carried on too quickly, the tobacco would have been of either a green or greenish yellow color. If too slow it would have been black like much of the country tobacco.

Referring to the report on tobacco by Dr. Forbes Watson, and his extracts from the treatise by Mr. Mandis, I perceive that the amount of nicotine in a great measure depends on the extent to which the leaf is allowed to ripen. The riper the leaf the more the nicotine. The amount of nicotine does not appear to depend on the curing.

The soil the tobacco was grown in is a hardish red Morrum soil containing much iron, probably that may account for the red coloring matter being so much developed?

The tobacco of which the cigars were made was *precisely* the same as the leaf sent. It was submitted to *no process whatever* by the manufacturer beyond the simple process of rolling it up into cigars. It was taken from the same heap as the leaf specimen sent, and was made up at once before me in my verandah.

I intend to have some of each description of the tobacco leaf analyzed, and also intended to submit the soil in which it was grown to the same process.

I have had some of the cigars packed up for some months to test how far they are proof against insects. None have been attacked by insects. Some Manilla cigars, some Trichinopoly cheroots and some of "Cope's cigarets," all packed up at the same time, have however been entirely destroyed by insects. As regards liability to attack of insects the experiment has been quite in favour of the tobacco cured by me.

I make these few remarks as I am anxious that we may at length arrive at the proper method of curing tobacco in this country. Thanking the Society for the kind trouble taken regarding the specimens sent by me.

DHARWAR, July, 1871.

Experimental cultivation with Peas at Umritsur.—Communicated by F. HALSEY, ESQ.

I have the pleasure to hand you railway receipt for 13 maunds, 15 seers Peas grown by me for the Society.

In October last you sent me :—

Blue Prussian	Peas	6 lbs.	the out-turn is	147 lbs.
Queen of Dwarf	„	9 „	„ „	147 „
Essex Rival	„	9 „	„ „	156 „
Carter's Surprise	„	15 „	„ „	374 „
Prize Taker	„	16 „	„ „	244 „
		55		1,068

The weight of Peas actually received by me fell short of what you stated by about 3 lbs., one sort, namely, Carter's Surprise having been packed loose in the box which was so insecurely fastened down that some seed dropped out on the journey. One bag of the Prize-Taker Pea had also burst, and some Peas from it became mixed with the Carter's Surprise Peas which accounts for the 15 lbs. of the latter producing so much more than 16 lbs. of the Prize-Taker.

It will be noticed that the old Blue Prussian Pea is considerably more polific than the others.

Carter's Surprise Peas have naturally got a small mixture of the Prize-Taker Peas among them, but both being tall sorts it will not signify so much.

The actual out-turn is $16\frac{1}{2}$ Imperial bushels, but the total weight is 1,068 lbs. which at 61 lbs. per bushel (a high average in England) gives over 64 lbs. to the bushel; the out-turn may consequently be considered a very good one.

This crop was produced on one Punjab beegah of land equal to .416 of an acre ordinary good loam, off which a heavy maize crop had just been taken.

The cultivation adopted was as follows:—On the Indian corn being cut the land was broken up with an ordinary native plough, and then once cross ploughed with Stalkartt's improved plough to the depth of 8 inches. The Peas were then sown broad cast on the freshly ploughed land, and, as it were, rolled in with the ordinary wooden *mai-i* of Bengal or *sowaga* of the Punjab.

They were not watered until they had been up six weeks, after which they were canal flooded as was thought necessary.

The cost to the Society is rent of land	Rs.	5	0	0
Watering at 1-8 per acre	„	0	9	11
Watcher 2 months, at Rs. 3 per month	„	6	0	0
7 Gunny Bags, at 5 annas	„	2	3	0
Labour			nil	
(My own servants and very slight.)				
Freight to and from Umritsur you will have to pay				
	Rs.	13	12	11

The Secretary mentioned that the cost of railway freight to and from Umritsur and the original cost of the seed, added to the above Rs. 13-13 would make a total expenditure of Rs. 76 only for this large quantity of $16\frac{1}{2}$ bushels, against Rs. 370 the cost of the same quantity from America, exclusive of freight and other contingent charges.

The best acknowledgments of the Meeting were given to Mr. Halsey for the above very satisfactory report and for the trouble he has taken in raising this seed for distribution to the Members.

Tree-planting in Upper India.—(Extract of a letter from H. Cope, Esq., *dated June,* 1870, *and a Communication from the Offg. Inspector Genl. of Forests.)*

The extension of fruit-bearing trees amongst the *people* is one deserving the special attention of your Society, and you would render the whole country the greatest service by pressing on the

official community of all classes, European as well as native, the advantages that must arise to the great mass of the population from increasing the capabilities of the country in this repect. It is a fact that so large is the consumption of wood, when that is still used for fuel, that in the Districts of Meerut, Mozuffernuggur and Seharanpore the fine old mango trees that form in groves (topes,) the sole ornament of those parts, are being cut down by greedy Zemindars, who thus sacrifice the past of half a century's growth, and the future of hundreds of maunds of fruit, for the immediate realization of a little ready money.

The wholesale destruction has, I believe, attracted some attention on the spot, but it is difficult legally to interfere with the rights of private property. Would your Society consider it within the scope of its objects to press on the Government the consideration of some Legislative enactment, if not for the preservation of trees, at least for the compulsory planting of five or ten young trees for every old one cut down? If some stop be not put to this wholesale destruction of the principal tree vegetation of the land, fears may reasonably be intertained that the atmosphere will undergo a material and most unsatisfactory change, and that the average rain-fall will be considerably reduced. The Forest Department might be entrusted with the superintendence of measures connected with this inroad on the main barrier to the increase of heat and the proportionate decrease of agricultural produce.

Major Pearson presents his compliments to the Secretary to the Agricultural and Horticultural Society, and, with reference to his note to Dr. Brandis of 17th September last, begs to inform him that it was Dr. Brandis' intention to have drawn up a report as to what had been done by the Government of India to check the indiscriminate destruction of trees in some parts of Upper India, as referred to by Mr. Cope in his letter to the Society, extract of which was forwarded with his letter.

In Oudh, and in some parts of the North-Western Provinces, the land revenue, it is believed, is partially remitted on lands covered with groves. In the Central Provinces large sums are annually spent in planting trees, but hitherto, except in some cases, the operations have not been very successful, as the climate militates very much against the establishment of trees without they are constantly watered, and this is a most expensive operation. In Berar, revenue is remitted on land covered with plantations, but, as under the ryotwaree system of land revenue, the trees after 20 years become by the terms of the Settlement the property of the holder of the land, there seems no legal power of preventing their being cut down. When in charge of the Berar Forests, Major Pearson in vain entered protest after protest

against the cutting down of the old village tamarind and mangoe trees to feed the cotton gins, where the wood easily fetched Rs. 25 or 30 per tree for fuel; perhaps the discovery of coal in the Wurda River may be the best friend to the groves of trees in Berar.

The evil resulting from the destruction of trees has been and is constantly pointed out by the Civil Officers to the Zemindars, and there can be no doubt that a District Officer who really chooses to do so may do much to prevent their wanton and unnecessary destruction, and a Circular embodying the views of the Council, will be submitted by this Department to Government for sanction.

It may be stated however, for the information of the Council, that in the Punjab, which is the most denuded of trees of any of the provinces of Upper India, Government is now spending nearly a lakh of Rupees annually by direct agency on plantations. In the North-West Provinces also a special officer has been appointed for the propagation of fruit trees at Raneekhett for distribution over the country.

Remarks on the Wild Medicinal Bael of the Himalaya, by LIEUT. J. F. POGSON; *with notes thereon, by* MR. JOHN SCOTT.

Some years ago, the Indian Government caused bael plantations to be formed at various stations, for supplying European and other hospitals, with fresh bael fruit. The Presidency of Madras took up the question, and at the request of that Government the Horticultural Society of India sent supplies of the finest ripe bael fruits, procurable in Calcutta to Madras. The seed extracted from this choice edible fruit, was sown, and perhaps the plantations formed are now in full bearing.

On hearing of the determination of the Madras Government to form bael plantations, I brought to its notice the fact that the bael fruit used by me in the preparation of my Compound Bael Powder, for the cure of diarrhœa and dysentery, was produced from the wild medicinal bael of the Himalayas. That this variety, even when ripe, was not edible, on account of its medicinal properties, and I urged that as the object in view was to provide a remedy for dysentery, and not a desert fruit, for the table, the proper course to adopt was to form medicinal bael plantations, in the Madras Hills, at a suitable elevation from 1,500 to 4,000 above the level of the sea, the young plants and suckers being sent from the Hurreepore* bael forest. The Government of Fort St. George referred the matter to some person in the Forest

* Hurreepore is on the Old Simla Road, and is the second march from Kalkah to Simla, Kussowlee being the first.

Department for report, and in due time it was informed that the *Aegle marmelos* was perfectly well known in Madras, and that there was no necessity for sending to the Himalayas for bael. The fact of these being a medicinal variety, was not believed, and in due time I was instructed accordingly. I was at the Hurreepore dâk bungalow on the 31st March, and seeing the bael forest the Madras correspondence came to my recollection, and I resolved to gather some of the fruit and leaves for transmission to the A. & H. Society in order that the question of the existence of the medicinal variety might be definitely settled.

I have therefore sent five full-grown specimens of this bael, to be kept for the inspection of sceptics, and I enclose some of the leaves. In the parcel I have also forwarded some of the dried fruit, as used by me. This variety of bael varies in size from a walnut, to that of a full-sized billiard ball. Of this size few are to be found. The fruit is tender to the middle of September after which the cortex begins to harden. The tree is from 12 to 16 feet in height. But the plant bears fruit, when four feet high, growing in a bush form; the fruit is always more or less pear-shaped. I think it will be admitted that the Madras authority was in error, and that the failure of local bael powder, and bael fruit, is due to the edible fruit being used in place of the medicinal one.

The time will come when the medical prejudice against the bael fruit will pass away, and under these circumstances it is advisable that reliable information on the subject should be recorded for future use in the proceedings of the Society.

The bael fruit of the "British Pharmacopœia" is the unripe dried fruit, of the edible bael or "*Aegle marmelos.*" This has been improved by cultivation and grafting, and the resulting "Kangzee Bael,"is the luscious delicious fruit mentioned by O'Shaughnessy in the Indian Materia Medica. I mention this to remove the prevailing impression that the esculent green bael, grafted, or ungrafted, is medicinal when dried, but is not non-medicinal when ripe. I never use the edible kind, and as the natural result, my remedy does not fail. But in the Government Hospitals, bazar bael is used, and I fear never succeeds. Thus the fruit is blamed in place of the want of knowledge. I dare say there is not a shop in Calcutta in which the *wild medicinal bael* is to be found. Yet the public place implicit confidence in the native Druggists, or "*Punsarree,*" and purchase his bael chips for medicinal purposes.

The *sherbet,* decoction, and spurious bael powder, made therefrom, does not answer expectation. The doctors very naturally oppose the use of bael, and condemn it as absolutely valueless, and they are quite right, for where *alvine fluxes* are concerned, the uncultivated (*i. e.*, not grafted) *Aegle marmelos* of Bengal and Upper India is of no value for medicinal purposes. In like manner the bael of Bombay and Madras being an uncul-

tivated edible bael, is no better than that of Bengal. Cultivation and grafting will improve the fruit, but human knowledge is not sufficiently advanced to convert a *non-medicinal* fruit into a *medicinal* one by cultivation; nor will any amount of cultivation cause the medicinal bael of the Himalayas to pass into a delicious edible fruit.

If the medicinal bael is to be raised in Bengal, the proper place for growing it is "Parisnauth" hill and it would answer in the Huzareebaugh hills. But being a hill sub-tree, its cultivation in the plains will not succeed."

KUSSOWLEE, 15*th April* 1871. J. F. POGSON.

With reference to yours of the 28th ultimo, enclosing for my perusal a letter by Lieutenant Pogson, on the so-called true medicinal bael fruit, with specimens of the leaves and fruit for examination. The fruits forwarded seem to me to belong to the variety called by the natives sreephul. Of this there is a wild and a cultivated form, and the former is that referred to by Lieutenant Pogson. The sreephul is doubtless a variety of the bael—*Aegle marmelos*—differing only I believe in the fruits, the shell of which in the bael—as recognized by the natives of Bengal—is smooth and rounded externally, whereas in the other it is flatter at the apex with a rough and more or less irregular surface. In the vicinity of Calcutta, the wild variety of the sreephul seems to be very scarce, and I have indeed seen no living specimen of it, though I hear from some of the mallees in the gardens here, that it is found in the interior of Bengal, and that the fruits do not differ from those which I have shown them from Hurreepore bael forest. I have no knowledge of the relative medical qualities of the wild varieties of bael and sreephul; but a decoction of the unripe and dried fruits of the former known as "*bael sooti*," is according to native practitioners an excellent remedy for diarrhœa and dysentery. Dr. Stewart also in his "Punjab Plants" states that "the pulp of the fruit, fresh or dried, is undoubtedly of use in affections of the bowels;" nor do I see any reason, he continues, "to place credit in a newspaper statement, that from the trees of these hills (Kangra) it is less efficacious than from those growing further east."

Lieutenant Pogson certainly, as I think, errs in asserting that no amount of cultivation will cause the medicinal bael of the Himalayas to pass into a delicious edible fruit. The bael and sreephul are undoubtedly varieties of one species, and we find the better kinds of both deteriorating alike when their culture is neglected; the fruits then decreasing in size, and becoming less palatable. I thus see no reason to doubt but that the wild sreephul has given rise to the edible variety of our gardens. The better kinds of both varieties reproduce themselves truly by

seeds, and they are thus rarely increased by layers or grafts. I send for comparison a few fruits of the wild variety of the bael.

Lieutenant Pogson forwards, as he remarks, specimens of the leaves and fruit "in order that the question of the existence of the medicinal variety might be definitely settled;" thus assuming that recognized botanical differences indicate also the relative chemical or medical qualities, which of course they do not. The question at issue can only be settled by chemical analysis, or perhaps better by practical experiments, and thus showing their relative efficacy in the treatment of affections in the bowels. ...... The remark that the variety referred to "being a hill sub-tree, its cultivation in the plains will not succeed" is indeed in the absence of direct experiments, a bold assertion. Within my own experience I could mention not a few Indian trees, many shrubs and herbaceous plants, affecting much higher altitudes than that at which the so-called medicinal bael is found, and which nevertheless thrive well in the plains. Indeed, as I previously stated, the mallees in the gardens here assure me that this variety is indigenous in the interior of Bengal. Dr. Stewart also states that "this small tree which is not uncommon at different places below Simla to about 4,000 feet, extends sparingly up to near the Indus, and is said by Bellew and others to be found beyond that river; *it is occasionally seen* planted in the plains, the stems *attaining a girth of from two to three feet*:" the italics are mine.

J. SCOTT.

I have carefully perused the observations, made by Mr. J. Scott, on my communication, in which the medicinal wild bael of the Hurreepore forest was brought to the notice of the Agricultural Society of India, and appears in the proceedings of the Society, published on the 18th May last.

Mr. Scott holds the opinion that the bael of Hurreepore, of which full-grown samples were sent down by me, is identical with the *Sreephul* of Bengal, of which Mr. Scott candidly admits, he has '*seen no living specimen.*' The samples sent were shown by Mr. Scott to 'some of the mallees in the gardens here,' and the result of the reference speaks for itself. Mr. Scott *heard* from the mallees, that, '(*sreephul*) is found in the interior of Bengal, and that the fruits do not differ from those which I have shown them from Hurreepore forest.' Mr. Scott also states:—'In the vicinity of Calcutta the wild variety of the *sreephul*, seems to be very scarce' Mr. Scott has never seen the wild variety of the *sreephul*, from which the conclusion may be drawn, that he has seen a variety of *sreephul* which is not wild. Before proceeding further the first question to be decided is—What is the *sreephul*?

Sreephul is a compound Sanscrit word. *Sree* is one of the

names of *Lutchmee*, the wife of *Visnu*, and the goddess of plenty and prosperity. *Phul* means fruit of any sort.

According to certain authorities, the self-sown, or the self-grown, *edible* bael fruit of Bengal, *Aegle marmelos*, is called the *sreephul*; I presume to distinguish the tree and fruit from the superior or cultivated bael, grown for the table.

In the plains of Upper India, the Punjab included, we have first the self-sown, or ordinary edible bael fruit—called for the sake of distinction—*Keit-ee-ah* (woody, ligneous) bael; and, second, the *Kaugzee*, or large thin-shelled grafted bael, grown for the table. The word *sreephul* is not current in Upper India, and would seem to be a pet or fanciful name, given by the people of Bengal to the *Aegle marmelos*, when found growing in the forest, or elsewhere, behind or near a Hindoo temple, for example.

In these hills we have two kinds of Walnuts, and Pomegranates, called respectively *Kuteah or Khaugee*—to distinguish the self-sown from the superior or cultivated variety, and the bael in the plains is similarly distinguished. Mr. Scott's mallees say that the *sreephul* with which they are, or pretend to be, acquainted is to be 'found in the interior of Bengal.' If so, let them produce some samples as gathered from the tree; and, if two or three are sent to me by banghy post, I think I shall have little difficulty in deciding whether the fruit is medicinal like the Hurreepore bael, or not.

I believe the Calcutta fire-work makers use the thick hard shell of globular wild fruit, resembling the bael (*Aegle marmelos*) in the manufacture of artificial bomb-shells. Perhaps, this is the *sreephul* of the mallees, if there is a separate local name for the uncultivated and ungrafted edible bael fruit.

I have stated that the wild medicinal bael of Hurreepore will not grow in the plains. Leaving my opinion out of the question, it would be a great point gained, if Mr. Scott could form a plantation thereof in the Royal Botanical Gardens. There is no scarcity of young plants in the Hurreepore jungle, and as they might be removed in the rains, the fact of this variety of bael (which I decline calling the *sreephul*) growing and bearing fruit in the vicinity of Calcutta, would be particularly demonstrated. I can vouch for the chemical or medicinal quality of the bael fruit of Hurreepore, and I know from analysis that its components differ very considerably from any edible fruit.

Mr. Scott can have no idea of the immense difference of opinion prevailing amongst Medical Officers of considerable experience on the sanative powers of the bael fruit. The bael, recognised in the London Pharmacopœia, as the genuine article, is officially stated to come from Malabar and Coromandel, and its liquid extract is the authorised preparation. The bael of Bengal, as far as the British Pharmacopœia is concerned, is silently ig-

nored. But a daring London Chemist, (Gould* of Oxford Street) anonymously supported by a retired Bengal Medical Officer, supplies old Indians and others, with the "Liquor Belæ of Gould," guaranteed to be made from Bengal bael, the virtues of which cannot be sufficiently extolled. Professor O' Shaughnessy informs us that the pulp of the ripe edible bael fruit is harmless and most delicious. Mr. Gould informs his London friends that the jelly made from the pulp of the ripe Bengal bael, (from the dried green fruit, of which he makes his Liquor Belæ) in the place of curing dysentery, has an opposite effect, from the unripe fruit being a gentle but effectual laxative.

The bael of the London Pharmacopœia has been analysed, and London physicians of note, who are opponents of Indian bael, advance and are prepared to maintain the doctrine—'That there is no need of a medicine like the bael, for that dysentery can either be cured without it, or an artificial bael compounded of tannin and mucilaginious ingredients.' One Medical Officer asserts, that much of the efficacy of the bael 'may reside in the thick mucillage† which surrounds the seeds of the fruit, and another M. D., Lond., L. R. C. P., states, positively of all the vegetable astringents I have found, *none equal* to a strong decoction of the rind of the bael fruit of Bengal; another medical authority states, that the juice, of the unripe fruit is the part to be used for dysentery.' The Bombay Medical Board, when opposing the introduction of my bael powder, stated in their report, that the bael of that Presidency produced dysentery in place of curing it, and, therefore, they would not hear of my preparation being tried.

The Madras Medical Authorities, though having no faith in Madras bael, gave my preparation a fair trial, and the official report as per margin speaks for itself. On a copy of the document being sent to the Government of Bombay, the official opposition of the medical authorities was withdrawn in 1863. But the result of the trial was never communicated, though from the fact of very large quantities of my preparation having been indented for by the leading Bombay

EXTRACT FROM OFFICIAL REPORT.

From the Principal Inspector-General, Medical Department, Madras, to the Secretary to Government, Military Department, Fort Saint George, Dated Bangalore, 11th August, 1862.

I have the honor to report, with reference to proceedings of Government, as per margin, that Lieutenant Pogson's specific for Dysentery and Diarrhœa (Compound Bael Powder) had been extensively tried in the hospitals of this presidency, and amongst the families of officers and others.

(Military Department, No. 2472 of 6th July 1860.)

The Medical Officers, who have used the remedy, speak very favourably of it. In some cases of which I have personal knowledge, it acted most efficaciously in relieving chronic dysenteric symptoms, after the failure of most other medicines.—(True Extract.)

(Signed) J. FRED. POGSON.

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* "Gould's Pamphlet on Indian bael, or bela, Edited by a late member of the Profession, Bengal Presidency." Published by J. Shaw, Bookseller, 256, Oxford Street, W. London, for F. Newbery and Sons. Price six-pence.

† "Thick mucilage."—Another authority, states, the cut slices should be sun-dried at once; the seeds and any little gum there may be being first taken out, and specially the gum as it is considered to perhaps counteract the medicinal property of the preparation", *i. e.*, the dried slice half green fruit.

Chemists, (and, under especial instructions sent in the first instance, by banghy post), shortly after, and continued till the firm collasped, it is reasonable for me to draw the conclusion that another success had been achieved. A perusal and consideration of the facts given, will show how necessary it is that the question of the *bael of Hurreepore* being a medicinal variety of the *Aegle marmelos* should be definitely settled.

I have quoted the London or British Pharmacopœia to show that the bael of Malabar and Coromandel is officially acknowledged as a remedy for dysentery and alvine fluxes, by the Royal College of Physicians, whilst the bael fruit of Bengal passes unnoticed.

I have placed on record that the experienced Medical Officers of the Bombay and Madras Presidencies have condemned the bael fruit of Malabar and Coromandel as of no value for medicinal purposes. I have elicited from Mr. Scott the admission, that the medicinal bael of Hurreepore is something that he has never before seen, though from what his mallees (or those consulted) say it may be the *shreephul* of the interior of Bengal.

I have shown what contradictory opinions are held on the bael question by Medical Officers, and as my knowledge and experience of thirteen years is of no value, even when simply opposed by an inexperienced Doctor, fresh from College, I trust the Council of the A. & H. Society will cause a London Chemist of standing to undertake the analysis of a sufficient quantity of the properly prepared medicinal bael fruit of Hurreepore, which I will forward in due course.

The Chemist employed should receive no information as to the substance submitted for analysis, which should be of the most complete and searching description.

I am well aware that Dr. Waldie, of Calcutta, could do all that was needed, but a London analysis carries with it a degree of authority, which no Medical Officer will dispute, whereas a local analysis would be received only on sufference.

The expense of the analysis may be costly, but its value will be great, inasmuch as it will pave the way for the introduction of the Hurreepore bael into France, Spain, Turkey and Russia; and thus these countries will become possessed of a very valuable medicine for the cure and treatment of alvine fluxes.

"Extract.—*British Pharmacopœia.—P.* 29, *last edition*:—
"*Bela—Bael.*"

"Aegle marmelos D. C. Plate Pharm Journal, vol. X, page 166.

"The half-ripe fruit dried from Malabar and Coromandel characters. Fruit, roundish, about the size of a large orange with a hard woody rind, usually imported in dried slices, or in fragments, consisting of portions of the rind, and adherent dried pulp and seeds. Rind about a line and a half thick, covered with a smooth pale brown or greyish epidermis, and internally, as well as the dried pulp, brownish, orange, or cherry red.

"The moistened pulp is mucillagiums, Preparation. *Extractum liquidum.*"

J. F. POGSON.

Mr. Scott's observations on the foregoing.—It is with some reluctance that I again intrude on your indulgence, and request permission to notice Lieutenant Pogson's *further Observations on the Hurreepore bael;* though I may at once state that their perusal has in no way shaken my belief in the specific identity of the latter and the *shreephul* of Bengal. The writer lays considerable stress on my not having seen living indigenous specimens of the *shreephul*, and he would thus (apparently to his own satisfaction) clear the pet beal of Hurreepore, from any close kinship with the *shreephul* of Bengal. Had Lieutenant Pogson maintained this on purely medico-economic grounds, I should scarcely have discussed the subject further; but as he will insist on distinctive, though undefined, morphological characters also, and thus impeach the accuracy of my previous statements, I am no way disposed to pass it unchallenged. I have thus made a comparative re-examination of his specimens with those which we have here, and the result of the reference shall again speak for itself:—The *Ægle marmalos, Corr.* (Correa da Serra, a Portuguese Botanist, *is* the authority for the species, *not* De Candolle as given in Lieutenant Pogson's extract from the British Pharmacopœia) the bela, (also blea, bilva, and sreephula) of the natives, is a thorny shrub or middle-sized tree, according to the less or more favourable conditions in which it grows: the leaves are pinnate, with three, rarely five, unequal, oblong or broadly-lanceolate and crenulate, leaflets, of which that at the apex is the largest and petiolate, the lateral one almost seassile; the common petiole cylindrical and tapering. The peduncles are axillary, bearing a few large whitish coloured flowers on long pedicels: they consist of a 4—5 toothed calyx, a similar number of spreading petals, numerous free stamens (30—40), with an ovoid, 8—15 celled ovary, containing many ovules. The fruit is less or more globose, not unfrequently in the wild state, somewhat turbinate, or top-shaped, and consists of a hard and woody, smooth, or somewhat rugose rind; the interior from 8—15 celled; each cell containing from 6—10 wood-coated seeds, surrounded by a copious, tenacious and transparent mucous, and imbedded in a yellowish aromatic pulp. It is indigenous in various parts of India, in the Malayan Peninsula, and in some of the islands of the Archipelago; cultivated from time immemorial, and naturally possessing a plastic constitution; it is found in most diverse conditions thriving, though dwarfed much in its northern limits in the Punjab, as it is also in the hot and arid hills, which it affects in South India. It there forms a mere thorny scrub, scarcely recognisable in the tall, erect and but slightly spiny tree, which we find in the equally hot and humid forests of the

Malayan Peninsula and islands of the Archipelago, or even in the less equable climate of Bengal. Equally protean is it as regards the shape and size of the fruit which varies from turbinate, to perfectly globose, and in weight from six ounces to eight pounds avoirdupois. . . . Now, for the so-called Hurreepore medicinal bael; it occurred to me after writing my previous memorandum on the bael, that I had seen fruits in all external respects similar to those of Hurreepore in the Chittagong district; and on reference to my notes I find this to be the case. The fruit is there described 'as a small somewhat turbinate, rugose rinded bael, the tree of a shrubby habit, and about 20 feet in height: found in the Sungoo District and also on Seetakoond Hill.' Again, Lieutenant Pogson, in his former communication to the Society, suggests Parisnath as one of the most likely sites in Bengal for the cultivation of his medicinal bael; as it happens, nature has forestalled him in this, as it is indigenous thereon, and certainly for all botanical purposes identical with that of Hurreepore. I quote from my notes of a visit to Parisnath in February 1868: '*Ægle marmelos* occurs somewhat sparingly at the base and on the flanks of the hill and also with *Terminalia Chebula* at an elevation of about 4,200 feet; found fruit-bearing plants: these dwarfed, scrubby and spiny as compared with those below; the fruits also smaller, but turbinately globose with an uneven surface, as on those at lower elevations.' According to Dr. Carey the bael is indigenous in the vicinity of Serampore; but for my part I am disposed to think that neither there, nor indeed anywhere in the vicinity of Calcutta, do any truly wild specimens occur: those which we do find in woods and waste places are all, as I suspect, the degenerated progeny of cultivated kinds. This is probably the origin of the few fruits from a wilding plant, which I submitted to the Society with my previous communication. These fruits were of small size; on an average two inches in diameter nearly globose, or in a few turbinately globose smooth rinded and unedible, or at least anything but palatable; and according to the native nomenclature they were of the variety called bael. The Hurreepore bael is described by its patron, as a tree of from 12—16 feet high; 'but the plant bears fruits when four feet high' (so do the cultivated baels, litchi, mangoe, &c.) growing in a bush form: the fruit varies in size from a *walnut*, to that of a *full sized billiard ball* (*of this size few are to be found*, and always more or less *pear-shaped*.') Such is the description afforded us of the Hurreepore bael, and with which, as it so happens, the fruits (though sent as we are told 'for the inspection and conviction of sceptics') do not well agree: all have an uneven rind and are less or more globosely turbinate, or, in simpler language, roundish, with an abrupt contraction towards the footstalk—*none pear-shaped*—and the fruits are from $1\frac{3}{4}$—$2\frac{1}{4}$ inches broad by 2—$2\frac{1}{2}$ deep. Thus, botanically, as I have

already said, they do not differ from those above described as indigenous in the Chittagong district and on *Parisnath,* and are of that variety called *shreephul* by the natives. In my previous communication I pointed out the characters by which the natives distinguish the bael from the *shreephul,* and I confess to some little surprise on observing that the first question according to Lieutenant Pogson yet to be decided is:—*What is the shreephul?* 'Then follows an etymological disquisition on the term *shreephula,* which concluded, we learn, that according to certain authorities the self-sown, or self-grown, *edible* bael of Bengal is called the *shreephul.* I presume, continues Lieutenant Pogson 'to distinguish the tree and fruit from the superior or cultivated bael grown for the table.' This is a mistaken notion: as I know that some of the largest and finest specimens of this fruit which have been exhibited for some years back at the Agri-Horticultural Society's shows, were of the variety called *shreephula.* The size or quality of the fruit has nothing whatever to do with the name, which is indifferently applied to those of a small or large size with rugose or uneven rinds, even as that bael is applied to the smooth-rinded; though of course there are many both educated and uneducated natives, who know nothing of such distinctions. With reference to the application of the term *shreephula* to this fruit, we learn from a note of Sir William Jones in *vol.* 2 of the *Asiatic Researches,* that it 'is called *shreephula,* because it sprang,' say the Indian poets, from the milk of *Shree,* the goddess of abundance, who bestowed it on mankind at the request of Jowarra; whence he alone wears a chaplet of Bilva flowers; to him alone the Hindoos offer them; and when they see any of them fallen on the ground, they take them up with reverence, and carry them to his temple.'

Lieutenant Pogson suggests that it may be the woody rind on the *shreephula* of the mallees 'which the Calcutta firework makers use in the manufacture of artifical bomb-shells.' I can inform him that both large and small shells are in common use (smaller size most so, as being the least expensive when prepared) as are also the shells of cocoanuts, and the coverings of various other seeds.

Lieutenant Pogson suggests a trial of the Hurreepore bael tree in the gardens here, remarking that 'it would be a great point gained if Mr. Scott could form a plantation thereof in the Royal Botanic Gardens.' I shall indeed endeavour to get a few young plants of this tree for garden-culture here, but to form a plantation therein, must needs be a subsequent consideration for the Superintendent when it has been satisfactorily shown that the therapeutic qualities of the Hurreepore bael are really superior to those of the common cultivated or uncultivated sorts. Lieutenant Pogson evidently regards this as an established fact; on the other hand, as I read the evidence adduced

seems most dubious! in fact gives no support to the assumption. Thus, I believe that Pogson's compound bael powder as a specific for diarrhœa and dysentery, was first brought to the notice of Government by a communication from that gentleman in 1858, and circulars were then issued by the Medical Board, recommending the use of the bael in the army. The results seems to have been generally unsatisfactory. Later, in 1860, the Inspector-General of the Medical Department, Madras, reports favorably of its remedial qualities, as shown by the extract which Lieutenant Pogson now submits to the Society. This, we are told, induced the Bombay Medical Board to cancel their previous objections to its use; but strangely enough, we find that 'the result of the trial was never communicated:' probably some will be uncharitable enough to hint that it may have proved inert or positively prejudicial. Be this as it may, Lieutenant Pogson, though thus overlooked by the Medical Board, evidently consoles himself with 'the fact' as he says 'of very large quantities of my preparation having been indented for by the leading Bombay Chemist shortly after,—*and, 'candeur admirable!'—continued till the Firm collapsed:*' the italics are mine. Conclusive, however, though this evidence does appear, the author would nevertheless have us believe, that 'a perusal and consideration of the facts given will show how necessary it is that the question of the *bael of Hurreepore* being a medicinal variety of the *Ægle marmelos* should be definitely settled.' It does not occur to Lieutenant Pogson that he has himself afforded us a truly crucial instance in the simultaneous '*collapse*' of the leading Bombay Chemical Firm, and the demand for his compound bael powder. Certainly, the enquiries which would doubtless have been made by 'a discerning public'—as the vendors of quack nostrums have it—benefited by the powdered bael of Hurreepore, would have induced other firms to indent for it: presuming of course that the 'large quantities' really had been dispensed not merely indented for and stored; proving one among the other unfortunate speculations which may have led to the aforesaid 'collapse.'

Lieutenant Pogson, evidently determined on showing us that there are medicinal and non-medicinal varieties of the bael, states that while the bael of Malabar and Coromandel is recognised in the London Pharmacopœia that of Bengal 'is silently, ignored,' and thus on purely negative evidence, he would have us believe that the latter is of no medical value. It does not occur to him that the true explanation may be simply one of relative cost: thus, in Bengal, the wild bael is but sparingly distributed, whereas it is abundant in Coromandel and Malabar, and can thus be supplied at a much lower price than in Bengal. Then, as to the cultivated varieties, the local demand for the ripe fruit is in Bengal quite equal to the supply; and the grower finds the sale of the fruit much more profitable in the ripe than in the unripe state. Again, on the stale assumption that the Hurreepore

bael is the alone *bela medicinalis veris :* we are told of a '*daring*—probably because he silently ignores the bael of Hurreepore—*London Chemist*'' who presumes to supply a liquid extract 'guaranteed to be made from Bengal bael, the virtues of which cannot be sufficiently extolled.' This is extracted from the green fruit, whereas the jelly made from the pulp of the ripe fruit, in place of curing dysentery—as does the above extract—has an opposite effect; 'being a gentle but effective laxative.' Lieutenant Pogson has, I submit, justly enough remarked on my inconversance with the conflicting opinions of medical officers on the therapeutic qualities of bael, though, as it appears to me, he places himself in very much the same category in tacitly discrediting the above statement of Mr. Gould, as to the opposite qualities of his preparations from the ripe and unripe fruits. Like phenomena are not uncommon in the vegetable kingdom, and as regards the case in point, it has been remarked upon years ago that even the same preparation may be beneficially administered for diarrhœa and constipation. Thus, in the *Lancet for* 1853, Sir Ranald Martin, M. D., says that, 'a singular property of the fruit is this, that it does not merely restrain undue action of the bowels, as in diarrhœa and dysentery; but also in cases of obstinate habitual constipation acts as a mild and certain laxative. It may be said in all cases to regulate the bowels.' Dr. Waring in describing its properties says that 'it is not improbable that its action is that of a mild stimulant of the intestinal mucous membrane, as experience has shown, that whilst it tends to arrest diarrhœa when present, it no less certainly acts as a laxative when constipation exists. Under each circumstance it seems to give tone to the intestinal tube.' *Pharmacopœia of India.* As opposed to the above, Lieutenant Pogson states, on the authority of Dr. O'Shaughnessy 'that the pulp of the ripe edible bael is harmless and delicious.' I do not find any such statement in the Bengal Dispensatory; and the quotation that 'Roxburgh *correctly* states the fruit to be delicious to the taste, and very fragrant' is admittedly from *Ainslie's Materia Medica.* Dr. O'Shaughnessy neither gives an analysis of the fruit, nor does he venture an opinion on its medical properties in the above treatise. We have it, however, on the authority of Dr. H. Cleghorn, late of the Madras Medical Service, that both the *Conserve* and *Liquor Belæ* as prepared by Mr. Pound, of Oxford Street, London, (from the half-ripe fruits exported from Calcutta and imported to Madras by Flynn and Co.) proved very useful in five or six cases of obstinate diarrhœa, and in the person of a young officer from Burmah, who suffered from great irritability of the mucous membrane after the expulsion of Tœnia by Kousso. The *Conserve* was spread upon bread, like marmalade, and the *Liquor Belæ* was given in doses of two table-spoonsful three times a day. Lieutenant Pogson would have us believe that the Bengal bael is of no medical value; doubtless he has done so in ignorance of the above favorable testimony, more of which he will find in Dr.

Grant's communication 'on the preparations and uses of the bael fruit,' to the *Indian Annals of Medical Science, for* 1854. I would also draw Lieutenant Pogson's attention to a quotation from Dr. Stewart's *Punjab Plants* in my previous note on the bael; the *newspaper statement* on which Dr. Stewart *places no credit,* having as I suspect reference to the assumed greater efficacy of the Hurreepore bael. This has been overlooked in the '*further observations*' as I cannot believe that the author knows so little of Dr. Stewart as to thus petulantly refer to him as the 'inexperienced Doctor fresh from College,' and simply opposed 'by whom, the author's knowledge and experience of thirteen years is of no value.' Whoever this may be, however, has very little to do with the question at issue, which is by no means confined to the opposed testimony of an inexperienced physician, and the thirteen years knowledge and experience of Lieutenant Pogson. We have records of results from some of the ablest and most experienced officers in the Indian Medical Service; and these certainly do not show that the Hurreepore bael is therapeutically more valuable than that of the wild and cultivated kinds from other parts of India. All have been fairly tested, and their remedial qualities—*such as they are*—are now well understood by medical officers, so that nothing new is likely to be elicited by the analysis suggested by Lieutenant Pogson. Analysis of both ripe and unripe fruits have been made by Dr. Macnamara and others, and comparative therapeutic results of the wild and cultivated baels disprove the assumption of their being medicinal and non-medicinal varieties. Dr. Grant has, indeed, many years ago, remarked that 'the relative worth and preferableness of one form to another is an enquiry by no means unimportant nor uninteresting;'—but this was written when the properties of the plant really were *sub-judice,* though he further states that—'there is strong reason to suspect that the occassionally unsatisfactory results of its use have been owing to imperfect administration of the remedy either from inattention in the selection of the fruit or carelessness in its preparation.'

In conclusion, I have great pleasure in appending the following note from Dr. Norman Chevers which will be read with interest as affording us a clear and succint statement of this eminent physician's experience of the therapeutic qualities of bael. 'I sometimes use still an extract of the *dried* bael prepared by Baboo K. L. Dey. It is *apparently* moderately useful in chronic bowel-complaints. For three and twenty years I have always had the bael in view, and, as you see, have never quite thrown it over; but the result of my conviction is that (accepting the fact that all plants have medicinal virtues) those of the bael stand very low. As a practical physician, I would never trust to the bael alone in any disease, unless I possessed no other drug, and I believe that should it be forgotten to-morrow (as it is by most physicians) it would be no loss.

JOHN SCOTT.

THE SORGO, OR NORTHERN CHINESE SUGAR-CANE, AS A FORAGE PLANT.

Read the following letter from the Secretary to the Government of India, Department of Agriculture, dated 23rd June, in reference to a memorandum from Colonel Boddam, on special duty under the Mysore Government:—

I am directed to forward herewith copy of a memorandum by Lieutenant-Colonel Boddam, relative to a forage plant called sorgo, and to state that the Governor-General in Council would be glad to receive any information the Agricultural and Horticultural Society may possess on the subject, specially with reference to any trials made with it in India.

2. I am also to invite the opinion of the Society as to how far, as compared with the yield of other crops that can be grown on similar soils, it is likely to repay cultivation.

This remarkable plant is a native of the north of China. Its giant growth, and its beautiful and graceful appearance and refreshing greenness in the driest season, and the expectation of finding in it a rival to sugar-beet induced the French Consul at Shanghai to send some sorgo seed to his Government. In 1854, Mr. Browne, Agent of the United States' Patent Office, took to America some French seed, which was distributed by the Government. The plant was cultivated by a few farmers, but it received little attention until an ex-Governor of South Carolina reported the results of his trials to a farmer's club, which brought sorgo into notice. Since 1855 its cultivation has steadily increased, and it is now one of the great crops of the country. It is grown in France and Algeria for alcohol chiefly, and in America for seed, forage, sugar, syrup, alcohol, vinegar and beer. In the 10 North-Western States, where it flourishes, there were in 1864, 3,66,670 acres of sorgo, and sorgo sugar was selling at Chicago at $4\frac{1}{2}$ *d* per lb. But for sugar, sorgo has turned out a failure. Its great merit as a forage plant is its principal recommendation, and on this point an official report of the United States Agricultural Department has declared that the *value of sorgo for feeding stock, cannot be surpassed by any other crop, as a greater amount of nutritious fodder can be obtained by it in a shorter time within a given space, and more cheaply.* While grass yields a ton or a ton and a half of hay, sorgo will yield from 2 tons to 9 tons of dry fodder. Sorgo *(Lootsoh)* flourishes wherever Indian-corn flourishes. The seed is sown for transplanting on warm ground, finely broken in the middle of April. The young plants are watered with liquid manure as soon as they appear, and in three or four days watering is repeated

Chinese method of growing Sorgo.

night and morning if the weather is dry. They are pricked out, when 6 inches high, in rows 3 feet wide and 6 inches from plant to plant, and are again watered with liquid manure when a foot high. Weeds are kept down by hoeing until the cane matures, about November.

The crop begins to come to market, however, early in September, or as soon as the stalks are sufficiently sweet for chewing. A Chinese laborer earning 10*d* a day, can cultivate about 2 acres during the 6 months that the crop needs his labor.

American Culture.

In America it is found that sorgo can be successfully grown on all lands where a fair crop of Indian-corn can be grown. Deep loose, warm soil, even of poor quality, produce the sweetest and most juicy stalks. Irrigation is recommended, but can seldom be attained in the United States. In deep black loam sorgo reaches a height of 16 feet or 18 feet; what will it not do on our future sewage farms? The juice of the giant growth is not so sweet, nor is it easily crystallized. The seed should be soaked 24 hours in tepid water, in which 1 oz. of saltpetre is dissolved to every 6 gallons. It is then dusted with gypsum, and drilled 2 feet apart and 20 seeds per foot (for forage). In seven or eight days a horse sub-soil plough is put between the rows, up one side down the other. This cultivation is repeated as the crop advances, but the plants must not be earthed up. The upper roots spring from the stalk above the ground and they must be left exposed. The first cutting may be made as soon as the crop is large enough for stock, and in ordinary seasons two others will follow. To dry the crop it should be set up in shocks, and the shock built with precautions for ventilation. One man with a sub-soil plough can cultivate 10 acres.

Directions for growing Sorgo as Forage.

Proposed method for Mysore.

Plough the land well and deeply, apply a liberal supply of stable manure, 6 to 7 tons per acre, if available, plough this in crosswise to the lines of the first ploughing, harrow and level, then sow the seed in drills, 26 inches apart, 20 seed per foot. In 7 or 8 days put a bullock hoe or cultivator between the rows up one side and down the other, or hoe the rows by hand. Continue this cultivation as the crop advances, but in no case earth up the plant stems, as they send out roots above ground which must be left exposed. The first cutting will be made when the stalk is near 3 feet high. The plant will afterwards send out side shoots for a 2nd and 3rd cutting. To dry the crop it should be set up in shocks, and the shocks built with precautions for ventilation. As dry cultivation sow sorgo in the beginning of the monsoon, as wet cultivation in October. In an uncertain climate like

Mysore the benefit of deep ploughing will be apparent in seasons of scanty rain-fall. The roots of the plants will be able to go down deep for moisture and nourishment, instead of withering near the surface. Though plenty of manure is recommended, sorgo will do fairly without much manure. The more manure the heavier the crop.

Submitted the following reply from the Secretary, dated 8th July, to the above communication, as also Mr. Scott's memorandum :—

I have the honour to acknowledge receipt of your No. 13 of the 23rd ultimo, enclosing copy of a memorandum by Lieutenant-Colonel Boddam, relative to a forage plant called Sorgo, and to reply as follows.

2. No reliable information has come before this Society in regard to trials made in India with the so-called 'Northern Chinese Sugar-cane,' 'Sorgo,' *(Sorghum (Holcus) saccharatum.)*

3. The well-known 'Jowar' or Janeera of Upper India is the produce of *Sorghum vulgare*, Pers. It is known in the Madras Presidency under the name of 'Cholum.' Some useful reports of results of trials made with 'yellow Cholum,' are introduced in the last annual report of the Government Experimental Farm at Sydapet, Madras, showing what can be done under careful cultivation. The produce of 'Jowar,' in good soil, is often upwards of a hundredfold, and much used for food (Roxburgh.) The straw known by the name of 'Kurbee,' is reckoned very nourishing for cattle, and is a substitute for forage for horses, when grass is not obtainable. The 'Deodhan' of Lower India (*Andropogon saccharatum*) Roxburgh, is also much cultivated during the rainy and cold season. This would appear to be closely allied to the *Holcus saccharatus* of Linnœus. Roxburgh remarks that "the only circumstance that renders him uncertain whether it is the same plant is the total want of the arista in the hermaphrodite flowers; in other respects they agree."

4. As such closely allied plants as the 'Jowar' and 'Deodhan,' are indigenous to India and give a fair yield under *ordinary* cultivation, it is not improbable that this 'Chinese Sugar-cane,' (if we do not already possess it) might prove an acceptable addition to our other forage crops; and with good management, would probably repay cultivation, both in yield of grain and stalk. As a saccharine producer, however, it could not complete successfully with the ordinary sugar-cane of the country.

5. I enclose a valuable memorandum with which the Society has been favoured by Mr. John Scott, Curator of the Royal Botanic Gardens, on this subject, and in which he also cursorily treats on the affinity of the cultivated sorts, which is quite overlooked in Colonel Boddam's paper.

MEMO ON THE SORGHUM SACCHARATUM PERS, AND THE S. VULGARE PERS.

The former is the *Holcus caffrorum of Thunberg*, and probably the Mabaalee or Kaffir corn referred to by Olcott in his treatise on the 'Sorgo' and 'Imphee.' The *Guinea* corn and *Imphee*, according to that author, are practically distinguished by the former being cultivated only as a grain-yielder, whereas the latter 'is grown only for its sweet juice, and, *never* to my knowledge, for its grain, which the Kaffirs say cannot be used as human food, in explanation of which I must state that they never grind their *Mabaalee* to extract the flour, but boil it whole in which form they consider the grain of the Imphee to be highly deleterious.'

The *Sorghum vulgare, Pers*, is the Jowar of the Bengalees, the *Andropogon Sorghum of Roxburgh;* and the *A. saccharatus* of the latter author—the 'Deo-dhan' of the Bengalees—is but a variety with muticous valves. The *H. saccharatus, Lin.* is described '*glumis glabris seminibus muticis*,' so that Roxburgh errs in the remark that "the only circumstance that renders me uncertain whether this is *Holcus saccharatus of Linnæus*, is the total want of the *arista* in the hermaphrodite flowers."

Botanists very generally distinguish the *S. vulgare* and *S. saccharatum*, by the former having a contracted and more or less erect inflorescence with villose glumes and awned seeds, whereas the latter has an open frequently drooping inflorescence, glabrous glumes and muticous seeds. These are, however, but extremes or well-marked varieties of a single species inseparably united by other cultivated forms, as are several others of the so-called species of Sorghum, judging from the living specimens which I have examined in the Botanic Gardens there, and of which the seeds were received direct from Professor Todaro, Palermo. Indeed Mr. Bentham in his review of Professor Targioni-Tozzetti's '*Historical Notes on Cultivated plants*' is, as will be seen from the following quotation, disposed to reduce all to a single species; thus:—'As to the cultivated *Sorghums*, most botanists distinguish several species, although none are to be found in a wild state, except those which have a more diffuse panicle with less-crowded flowers, and which come the nearest to the more luxuriant specimens of the *Sorghum halepense*, which is very abundant wild in some parts of Southern Europe, and all over Africa and India. Indeed, we believe it to be the opinion of an eminent agrostologist who has shown the soundest judgment in the investigation of East Indian and other *Gramineæ*, an opinion in which we fully concur, that the described species of *Sorghum* are mostly, if not all, mere varieties of the *Sorghum halepense*, produced by extensive cultivation during a long series of ages.'

Lieutenant Colonel Boddam in his memorandum, has overlooked the fact that the Jowar, or Great Indian Millet, is extensively cultivated in the West Indies, as it is indeed more or less in all tropical countries. Simmonds in his '*Commercial Products of the Vegetable Kingdom*' thus refers to it:—'Guinea Corn' the common name of Sorghum vulgare in the West Indies—is extensively cultivated in some parts of Jamaica, and chiefly used for feeding poultry. I did not, however, find it thrive in the north side of the island. It is best planted in the West Indies between September and November, and ripens in January. It ratoons or yields a second crop when cut. The returns are from 30 or 60 bushels an acre, but the crops are uncertain.

Mr. C. Bravo tried Guinea Corn at St. Ann's, Jamaica, as a green crop, sown broadest for fodder, and it answered admirably, the produce being very considerable. It was weighed, and yielded 14 tons of fodder per acre, and was found very palatable and nutritious for cattle. It was grown on a very poor soil, which had, previously to ploughing given nothing else but marigolds and weeds. The luxuriant growth of the corn completely kept under the weeds. A great number of the stalks were measured, and they averaged 10 feet from the root to the top of the upper leaf. It had been planted ten weeks, and had therefore grown a foot a month. Mr. Bravo is of opinion that sown broadcast it would answer either as a grain crop, as fodder, or ploughed in to increase the fertility of the soil.

Dr. Phillips of Barbados, being of opinion that it might be advantageously employed as human food, requested Dr. Sheir, the Analytical Chemist of Demerara, to determine in his laboratory its richness in protein compounds (the muscle-forming part of vegetable food) in comparison with Indian corn. He, therefore, caused a sample of each to be burned for nitrogen, when the following results were obtained:—

	Indian corn.	Guinea corn.
Water, per cent.	12·81	13·76
In ordinary state—Nitrogen, per cent.	1·83	1·18
Protein compounds.	11·51	7·42
In dry state—Nitrogen, per cent.	2·10	1·36
Protein compounds. ...	13·20	8·60

According to these results, the Guinea corn is less rich in nitrogen or protein compounds than Indian corn, though not much less so than some varieties of English wheat.

With reference to the variety called the Sorgo—Lootah of the Chinese—I had seeds from China in 1868 and devoted a plat to them in the gardens here. The seeds were sown towards the close of the rains; they germinated freely, attained a height of from six to eight feet and matured their seeds about the end of January. In a plot alongside of these, grew the Jowar and Deodhan of Bengal with their presumed normal form—*S. halepense Pers*, the *Andropogon cernuus of Roxburgh*,—and

certainly in so far as mere cropping was concerned, any of the latter, were superior to the Lootah of the Chinese; this being decidedly less robust than any of the former. No doubt this may be largely attributable to the changed conditions under which it was grown, and a more robust progeny may naturally be expected from country-grown seed. Admitting this, however, and remembering that we are dealing with mere varieties of one variable species, the question naturally occurs, will this Lootah (if really a superior fodder grass as compared with its indigenous Bengal kin) retain its highly nutritious characteristics under the acclimative process; or is it not more likely that it will thereby lose its presumed superiority? Practical experiments can of course alone determine this, but in such a question as the introduction of new forage plants it is well to draw attention to those of indigenous origin when such there are, so closely akin.

Cultivation of Cereals in Upper India.—Communicated by W. H. HALSEY, ESQ., *Secretary of the Public Garden, Cawnpore.*

I was very much struck by Mr Robertson's account of his experiment with selected seed in the Bolundshuhur district, [*See Vol. 2, page 38, of Correspondence and Selections,*] published by the Society in the middle of May 1870, and consequently applied to him for a sample to try in our farm here. He was good enough to send me a seer, but owing to its having been badly harvested, a great deal of the seed had lost its germinating powers, and I had repeatedly to resow the patch of ground I selected for it. The land was average Domut and well manured, and the only difference in the cultivating I made was to put the seeds in one foot apart instead of two. After repeated resowing I got the crop pretty even and after it was once up, it grew luxuriantly with a very coarse large-leaved straw, very dark in colour. It was very late in ripening, and was considerably injured by what is called "Girolie" here, and in England, rust. As the area, however was only 484 square yards, the out-turn was too small to give any reliable result per acre. The average number of ears from a single grain was 60, with an average of 62 grains to the ear. To an inexperienced eye it looked a very fine class of wheat, and being inexperienced in the classes of India wheat, I showed it to some of the grain-dealers in the bazaar; as in duty bound they all said it was very fine; and on asking them if they knew where it came from, they immediately said the Dekkan. I then asked them why they did not import it, and they all said no one would buy it, it made such very dirty coloured flour; one man informed me that he got up some lakhs of maunds of it for the Commissariat after the mutiny, but it was objected to, and had it not been for the scarcity in those days, he would have been unable to part with it. I afterwards took it to the Government miller, Mr. Eastaway, who informed me it

was no use whatever to him, he could not make flour out of it, that it would do to make Soogee of, but from its shape and the long hollow indentation in it, the stones would not be able to take the husk off, and that every English miller would condemn it.

I think, therefore, it would be advisable to place the sample No. 2, I have sent down, before the millers and grain-dealers in Calcutta, for their opinion before any further encouragement is given to the cultivation of it.

As an experiment I also tried the effect on some white wheat purchased in the bazaar for the purpose, and cultivated under exactly the same circumstances both as to soil, area, irrigation, &c. The result was—each grain produced the high average of 90 ears, each ear averaging 42 grains; but unfortunately the grain was sacrificed to the quantity of straw, and was so wretchedly poor, that my superintendent, in my absence, fed the fowls with it, and I am unable to send you a sample of it. I am satisfied to conduct such an experiment as this, some artifical manure would be necessary, the characteristic of which would be to increase the weight of the grain. There was also another drawback to both experiments; they took a good month longer to come to maturity than the country wheat under ordinary circumstances, and this necessitated frequent extra waterings which, as pointed out by Mr. Bridgeman, is a fatal drawback, necessitating as it does additional expense.

As my attention has been drawn to the subject of the weight and out-turn of wheat and barley crops in this country, it may not be out of place if I give you the information I have gathered on the subject.

For this purpose I have put up six bags of grain numbered and labelled in accordance with the accompanying table, and I shall feel obliged if you will take every opportunity to test the figures contained therein. Should they, as I believe, turn out correct, I shall have established the fact that weight for weight Indian wheat and barley are as good as English grain, and that our deficiency is only in the out-turn, *ergo*, if we only had the manure they have in England, we should have nothing to learn from that country in the matter of growing wheat and barley. Oats I have always found light in comparison with English seed, but I apprehend there is no such difference in this staple, but could be remedied by manure.

It will be understood that my average weights and average yields are distinctly averages, that there are both higher weights and higher yields, as there are lower weights and lower yields, and in inviting criticism on this table, I wish my critics to thoroughly understand this, and not to argue on exceptional circumstances:—

Sample.	Description of Grain.	Where grown.	Weight per Imperial Pottle.		Weight per Bushel.		Average weight per Bushel in England.		Average yield in Cawnpore district per Acre, fractions omitted.	Average yield in England per Acre.	Remarks.
			lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	Bushels.	Bushels.	
1	Red Wheat ..	Bundlecund .. .. .. / Purchased in the Bazaar.	4	0	64	0	63	0	20	33	*N. B.*—Samples 1,3,4 are discoloured owing to the heavy rains this year when the grain was still on the threshing floor.
2	Red Wheat ..	Model Farm, Cawnpore .. .. / Seed from Mr. Robertson.	3	10	58	0	63	0	22	33	
3	White Wheat ..	Cawnpore .. .. .. / Purchased in the Bazaar.	3	15	68	0	60	0	20	30	Wheat at 16 mds. per Acre.
4	Barley	Ditto	3	5	53	0	53	0	28	40	
5	Barley	Allahabad .. .. .. / From the English Seed acclimatized.	3	2	50	0	53	0	29	40	Barley at 18 mds. per Acre.
6	Barley ..	Cawnpore .. .. .. / From English Seed.	3	4	52	0	53	0	28	40	
7	Oats ..	Cawnpore .. .. .. / From English Seed.	2	3½	35	8	40	0	23	60	Oats at 10 mds.
8	Oats ..	Ditto	1	11½	27	8	40	0	30	60	
9	Oats ..	Cawnpore .. .. .. / From Seed obtained some years ago from Patna.	2	4	36	0	40	0	22	60	

Report of the Grain Committee on certain samples of Cereals submitted by W. H. Halsey, Esq., Secretary, Public Garden, Cawnpore.

Read Mr. Halsey's letter descriptive of the above samples, and after inspection thereof, we beg to report as follows:—

WHEAT.

No. 1. Is good floury wheat, but not suitable for soojee.

No. 2. Flinty, worse than Gungajelly, no use for flour. Soojee might be made from it, but the loaf would not be good, will not do for mixing; a very undesirable description.

No. 3. Good Dooda, readily saleable and the most serviceable for flour and soojee.

BARLEY.

No. 4. Country; nice grain, colour fair.

No. 5. Grain good, not so heavy, colour of flour much whiter.

No. 6. A very fine Barley.

OATS.

No. 7. From English seed, best.

No. 8. From Cawnpore seed, ordinary sample.

No. 9. Ditto from Patna, better than No. 8.

RESOLVED,—that the thanks of the Committee be tendered to Mr. Duncan, of the Phœnix Mills, for meeting the Committee, and for the assistance rendered by him.

Cultivation of Cotton at Munnipore.—Communicated by Major General W. F. NUTHALL, *Officiating Political Agent.*

In compliance with your request I now send you by banghy post, a larger sample of the Munnipore cotton. It was purchased in the market in this town where cotton is exposed for sale all the year round. Scarcely any piece goods are imported into the country owing to the difficulty of obtaining carriage across the hills, and the Munniporees therefore manufacture most of the clothing they use in domestic life.

This specimen was the best that could be obtained, but I am not aware of any varieties excepting that which naturally results from growth of the same seed in the hills and in the valley, the climate of which is less favourable to it. I paid 2 annas 6 pie for this specimen, which weighs 7 chuttacks; the rate per maund therefore would be Rs. 14 annas 4¼.

It is principally grown by the tribes around the valley, and the demand is such that many of them, the Kookies, specially, are in better circumstances than the people of the plains. This is evident from the liberal prices they pay for articles they require, such as Gongs, Das, &c.

This cotton, although of so good a quality, receives no cultivation whatever, nor is the land manured, excepting with the ashes of the jungle which grew upon it, fresh land being taken up every year. The seed is sown broad cast, and one or two weedings is all the attention it afterwards receives.

The soil on the lower slopes of the hills, east of the valley, is a rich black loam, better adapted for cotton than any I have seen in India, and there are hundreds of acres available, and I believe that all difficulties as to carriage might be removed; but at present there are insuperable obstacles to enterprise, not the least of which is, want of intelligence on the part of the Munnipore Government to its own interests and that of its subjects.

I came here just in time to prepare a field of cotton in my own grounds, on the principle recommended by Mr. Logan, and published in the Government Gazette, and it is coming on very well. The result I will communicate in due time.

Read also the remarks of the Members of the Cotton Committee on this sample:—

Mr. M. Henderson.—This is a remarkably good sample of Indian cotton, free from stains and seed, fair length and strength of staple, and altogether a very desirable description for home consumption. I would value it at about 8½d. per lb. in Liverpool.

Further particulars from General Nuthall would be desirable, say, the quantity *now* produced, the quantity that *could* be produced, and the nature of the difficulties in the way of increased cultivation and transport.

Mr. J. Thomas.—This sample for Bengal cotton has a very good staple, about equal to the best Bhomerghur that comes to this market, but is inferior to that produced on the Bombay side, both in length of staple and silkiness.

The colour is very good, but I think it would be impossible to get cotton in any quantity so *thoroughly clean* as this is In my opinion it would not bring here more than Rs. 3 over the price of fair Bengal though it would probably be worth about 8*d.* per lb. in Liverpool. It would be much fancied here (if well cleaned) for the China market.

Mr. T. H. Mosley.—This sample is somewhat irregular in *length* of staple as was the case with the small muster upon which I reported for General Nuthall in April last, and such irregularity is doubtless a result of the want of care in cultivation to which he refers in his letter. The cotton represented is, however, a valuable and very useful description for home consumption, and the best specimen of *hill growth* I have ever seen, being soft to the feel, of good colour and fair staple in length and strength of fibre—present value in the Liverpool market would be fully 8 to 8½*d.* per lb. taking mid Orleans at 9⅝. per lb.

It will be interesting to learn the result of General Nuthall's own experiment in field culture of this cotton, and meanwhile he might be requested to favour the Society with the further particulars referred to by Mr. Henderson. If quantity *is* available? I see no reason why a good price should not command the supply in good condition.

The Secretary mentioned he had applied to General Nuthall for the required information.

Monthly Proceedings of the Society.

Monday, the 23rd January 1871.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Monthly Meeting having been read and confirmed, the Chairman submitted the Annual Report.

The Report was adopted.

The Members next proceeded, in accordance with the Bye-laws, to the election of Officers and Council for the current year. The scrutineers (Messrs. C. E. Price and Protapa Chundra Ghosa) reported the result to be as follows:—

President—Mr. J. A. Crawford, c.s.

Vice-Presidents—Dr. C. Fabre Tonnerre, Mr. W. Stalkartt, Colonel E. H. C. Wintle and Rajah Suttyanund Ghosal Bahadoor.

Secretary.—Mr. A. H. Blechynden.

Council.—Messrs. A. H. Mowbray, L. Berkeley, S. H. Robinson, Baboo Romanath Tagore, Messrs. R. Blechynden, W. Pigott, S. P. Griffiths, M. Henderson, B. D. Colvin, J. M. Ross, Baboo Pratapa Chundra Ghosa, and Mr. T. H. Wordie.

Standing Committees.—The name of Mr. G. Conti was added to the Silk Committee; Mr. A. B. F. Thompson to the Fibre Committee; Mr. E. Vancutsem, to the Coffee and Tobacco Committee; Mr. J. H. Haworth to the Grain Committee; Mr. C. T. Insikpp to the Tea Committee; and Mr. W. Alexander, to the Fruit and Kitchen Garden Committee.

The ordinary buisness was then proceeded with, and the following gentlemen, proposed at the last Meeting, were elected Members:—

Captain E. C. Corbyn, Moulvi Mahomed Russeed Khan Chowdry, Baboo Goluck Chunder Ghose, Captain L. Blathwayt, Messrs. G. Toynbee, W. Lloyd Jones and T. M. Francis.

Rejoined.—Mr. G. A. Glascott.

The names of the following gentlemen were submitted as candidates for election:—

The Hon'ble Maxwell Melvill, Judge of the High Court, Bombay,—proposed by Major W. Nembhard, seconded by the Secretary.

Lieutenant-Colonel J. A. Wright, Cantonment Magistrate, Morar,—proposed by Colonel A. R. E. Hutchinson, seconded by Dr. R. F. Hutchinson.

Baboo Benode Behary Bannerjee,—proposed by Colonel E. H. C. Wintle, seconded by the Secretary.

N. J. Campbell, Esq., Kurnool Concern, Tirhoot,—proposed by Mr. J. J. Guise, seconded by Mr. T. H. Mosley.

F. G. L. Mathews, Esq., Nynee Tal,—proposed by Mr. J. A. Crawford, seconded by the Secretary.

Haldane Rattray, Esq., Assistant Superintendent of Police, Burrisaul,—proposed by Mr. A. T. Maclean, seconded by Mr. Crawford.

Alfred Powell, Esq., Saharunpore,—proposed by Mr. S. Jennings, seconded by Mr. A. Anthony.

J. A. Thompson, Esq., Chandeeghat Tea Garden, Cachar,—proposed by Mr. A. B. F. Thompson, seconded by the Secretary.

E. A. Thurburn, Esq. (Messrs. J. Thomas & Co.),—proposed by Mr. A. H. Mowbray, seconded by Mr. Crawford.

The following contributions were announced:—

1.—Report of Committee of the Bengal Chamber of Commerce, from 1st May to 31st October 1870. From the Chamber.

2.—Annual Report of the Administration of the Bengal Presidency for 1869-70. From the Government of Bengal.

3.—Progress Report of Forest Administration in British Burmah for 1868-69 and 1869-70; and *Flora Sylvatica* of the Madras Presidency, Part 3. From the Government of India.

4.—Report for October 1870, of the Department of Agriculture of the United States of America. From the United States Consul.

5.—Annual Report for 1868, of the United States Department of Agriculture, and Monthly Reports for 1869 of United States Department of Agriculture. From the Commissioner.

6.—Annual Report for 1868 of the Smithsonian Institution. From the Institution.

7.—Proceedings for 1868-69, Vol. XII., of the Boston Society of Natural History; Entomological Correspondence, Harris; and Gould on the Invertebrate of Massachusets. From the Boston Society.

8.—Journal of the Asiatic Society of Bengal, Part II., No. 4. From the Society.

9.—A collection of seeds gathered in Yarkand. From T. D. Forsyth, Esq.

10.—A basket of fruit of the pear-shaped Tomato and seed of the same. From F. R. Browning, Esq.

11.—Seed of the double Portulaca gathered at Ranchee. From R. W. King, Esq.

12.—A collection of seeds gathered at Tajpore Factory, Tirhoot. From C. E. Blechynden, Esq.

The following is extract of letter descriptive of this seed:—

"I have sent down by this opportunity a box containing:

1*st*, *Maize.*—I have ticketed those from American seed; those marked 1869 are from seed of that year grown in 1870; and those marked 1870 are from the seeds you sent me. I mentioned in a former letter that I found the seeds of this did

not succeed so well the first year, and send the ears in proof. I have kept seeds of both, and will no doubt do very well next year; all the rest of the maize is country, of my own growing, 2 years in succession. It has improved.

2nd, Zinnia.—Of this I have sent a large quantity, and will hereafter, I hope, send more; the flowers are beautiful from which this seed is taken, both Mr. King's Ranchee stock, and my own.

3rd, Variegated leaved Convolvolus.—Of this you will find some parcels. You cannot mistake the seed as they are variegated also!

4th.—There is also seed of Convolvolus minor. The flowers are very pretty resembling "Ipomoa rubro" in miniature.

5th, Carolina Paddy.—First and second cuttings from acclimatised and imported seed sent me by you, as also the ears that suffered from blight.

6th, Maize.—Growing in the place of the flowers. *(A lusus naturæ.)*

7th.—More Capsicums. The seeds can be extracted and well dried. I got the original seed from you. [From seed presented, in 1869, by Mr. D. G. Buckland, of Nepal.]

8th, Balsams.—From Mr. King and my own stock; flowers of all colors, large, and very full. I have never had such a display before as I had in the bushes from which this seed is taken.

13.—Six samples of Cotton raised in the Nicobars. From Colonel Man, Superintendent of Port Blair.

Wild Silk yielder in the Akyab District.

Read a letter from the Deputy Commissioner of Akyab, relative to a species of Silk Worm recently discovered in that district. *(See Correspondence and Selections.)*

Sericulture in Bengal.

The Secretary next submitted the following remarks from Captain Hutton, in reference to the observations of Mr. De Cristoforis, which were read at the last Meeting:—

"In the Proceedings of the Society of the 20th December 1870, appeared a letter from Mr. G. De Cristoferis complaining of my having, as he alleges, made some remarks reflecting upon him.

"Mr. De Cristoferis must permit me to deny the soft impeachment, and to assure him that no reflection whatever was intended; but as a faithful recorder of facts relating to sericulture, I was bound to point out for the benefit of others the errors into which Mr. De Cristoferis had *apparently* fallen.

"It was not for me *to guess* that the gentleman "alluded to the Centigrade and not the Fahrenheit" thermometer, so that the alleged reflection arose altogether out of his careless manner of expressing himself.

"I repeat, however, *pro bono publico*, that the system adopted by the natives of Bengal and their imitators, for *preserving* the eggs of annuals, is about the

worst that could have been devised, since the circulation of pure free air around the eggs is as essential for the well-being of the future insect, as for the well-being of man himself, and this is simply a sober fact and *no "witticism"* whatever; if Mr. De Cristoferis cannot recognise this truth, he will never become a thriving sericulturist. Sound sanitary principles are as essential to the preservation of insect health as to man himself, and this is all I intended to point out.

"As to improving the Polyvoltine species now under domestication in Bengal, it will be perfectly *impossible*, so long as the present system of cultivation is persevered in, for they receive not only poor feeding, but all attention to cleanliness and free ventilation is totally disregarded. Even the climate is inimical, for the worms cannot be reared upon the trees in the open air as nature intended they should be, and as I have done at Mussoorie with the alleged annual *B. textor*, and the Polyvoltine *B. sinensis*. Eggs of the latter transmitted to Bengal as soon as deposited would now reach their destination previous to hatching, and obviate the necessity of establishing a silk farm in Bengal where the same method cannot be pursued.

"In conclusion, I beg leave to express my regret that my remarks should have given offence to Mr. De Cristoferis to whom I wish every success."

Cotton in the Nicobars.

Read a letter from Colonel Man respecting the Cotton samples above referred to:—

"I send you specimens of various descriptions of Cotton grown in the Nicobars, some being raised from seed sent out by the Home Government, and one or two samples from plants found on the island.

"I shall feel obliged if you will kindly favor me with your opinion on their value as to quality and fibre. The seeds were sown rather late in the season, but the ground had to be cleared of jungle, and made ready for planting, hence the delay. The boisterous winds which prevail at the Nicobars have stripped the trees of a great number of their pods. I took one bush as a fair specimen, and 134 pods were counted on it, and the man in charge said that at least as many more had been blown off by the wind. (I mean to guard against this in future by planting the ridges.) Perhaps you can tell me if the abovenamed quantity represents a good yield."

Read the following report by a Member of the Cotton Committee (Mr. J. M. Ross) on these samples:—

No. 1.—This is certainly magnificent cotton, and has probably deteriorated little, if at all, from the parent stock. I make the staple equal to the best "Sea Island," but color and strength rather inferior, probably worth 19 to 20*d.* per pound.

No. 2.—Slightly inferior in staple to No. 1, but probably stronger. The sample is too small to judge from.

No. 3.—Similar to No. 2, but rather inferior in strength and color.

No. 4.—A good merchantable article, with a mean staple of about 1·1 inch, or equal to the best Uplands in this respect. A nice silky strong fibre, and probably worth about 10*d.* per lb.

No. 5.—The muster is very small, staple seems to have been injured by handling. It seems to me to class with Nos. 2 and 3.

No. 6—is clearly from Pernam stock, but I think has deteriorated, and would not be worth more than perhaps 8*d.* per lb. to-day.

The Secretary observed that sample No. 5 is very similar to some Cotton submitted to the Society by Captain Tulloch, of the *Day Dream*, in March 1860,—(Journal, Vol. XI., page 16, Proceedings of the Society.) The seed was probably introduced many years ago by the Danish Missionaries before these islands were ceded to the British.

Culture of Carolina Paddy in the Soonderbunds.

Read the following roport by Mr. A. M. B. Nicholetts, on Carolina Paddy sown in Haulgatchyea, Lot No. 109, and submitted a basket-full as a specimen of the produce:—

"This paddy so well known both in America and England, has hitherto defied the efforts of the Zemindars to cultivate to any extent.

"The present sample is raised from five maunds of seed imported from England by the Agricultural Society, and purchased by the exhibitor at rupees twenty per maund.

"The first experiment was tried on or about the month of July 1868, germination taking place in 12 days. Only two maunds of the five, however, germinated, the yield consequently being small.

"In 1869 thegermination from the result of the preceding year took seven days, and the crop was an average one.

"The next year, however, was very successful, inasmuch that the germination took place in three days. The amount sown was three hundred and fifty biggahs, and the crop about two thousand and four hundred maunds, a sample of which is the same now before the Board.

"The exhibitor feels certain that it is a staple that will repay any expense which Government may feel inclined to incur by supporting the grower.

"He, therefore, presents it before the Board for sale, at any price they may think fit to offer; as he can, by the Government supporting him, introduce the growth of this valuable commodity throughout the Soonderbunds, and thus greatly benefit the agricultural interests of India."

Letters were also read:—

From the Secretary to the Government of Bengal, dated 7th January, submitting some further particulars regarding the introduction of the Ipecacuanha plant into India.

From Messrs. Barr and Sugden, seedsmen, London, acknowledging receipt of order for seeds, and promising it their best attention.

From the Corresponding Secretary, Boston Society of Natural History, returning thanks for this Society's publications, and presenting certain copies of theirs.

From the Secretary, Smithsonian Institution, Washington, acknowledging receipt of copies of this Society's publications, and advising despatch of certain copies in return.

Tuesday, the 28th February 1871.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Monthly Meeting were read and confirmed.

The following gentlemen were elected Members :—

The Honorable Maxwell Melvill, Lieut.-Colonel J. A. Wright, Baboo Benode Beharry Banerjee, Messrs. N. J. Campbell, F. G. L. Mathews, Haldane Rattray, Alfred Powell, J. A. Thompson, and E. A. Thurburn.

The names of the following gentlemen were submitted as candidates for election :—

Lieutenant G. M. Rogers, 4th Goorkhas, Bukloh, Punjab,—proposed by General A. Prior, seconded by the Secretary.

G. L. Calder, Esq., E. B. Railway, Kanchrapara,—proposed by Mr. S. P. Griffiths, seconded by Mr. A. Murdoch.

James Murdoch, Esq. (Messrs. W. Moran and Co.),—proposed by Mr. Griffiths, seconded by Mr. Murdoch.

Major T. M. Shelley, late 11th Regt., Morar,—proposed by the President, seconded by the Secretary.

J. T. Rowett, Esq., Merchant, Rangoon,—proposed by Mr. R. Redpath, seconded by the Secretary.

Dr. James Wise, Civil Surgeon, Dacca,—proposed by Mr. J. J. Gray, seconded by the Secretary.

J. W. O'Keefe, Esq. (Messrs. Kettlewell, Bullen and Co.),—proposed by Mr. S. P. Griffiths, seconded by Mr. J. G. Meugens.

James Sutcliffe, Esq., Principal of the Presidency College,—proposed by Mr. Crawford, seconded by the Secretary.

Captain H. S. Jarrett, Staff Corps, Calcutta,—proposed by Mr. Crawford, seconded by the Secretary.

Colonel J. Gordon, Commanding at Jhelum,—proposed by the Secretary. seconded by the President.

J. M. Comley, Esq., M.R.C.S., Calcutta,—proposed by Mr. T. E. Carter, seconded by Dr. G. R. Ferris.

Lieutenant-Colonel H. Mills, Dy. Assistant Commissary General, Bareilly,—proposed by Captain H. H. Birch, seconded by the Secretary.

As an Honorary Member.—Baboo Peary Chand Mittra, on the recommendation of the Council.

The following contributions were announced:—

1.—A collection of fruit trees, Oranges, Limes, &c., from Debroogbur, Assam. From J. M. Wood, Esq.

2.—Bulbs of Achimines and Gloxinias. From Dr. T. Beaumont.

Dr. Beaumont writes—"I find Gloxinias do better if made to flower twice a year. I plant the bulbs *now* (January) they flower in April, are dried in May, re-potted and watered as soon as they begin to sprout in July, and they flower again in August and September. Treated thus the bulbs are finer, larger and grow much stronger than if flowered only once, and there is the advantage of two crops of flowers."

The bulbs have been transferred to the Botanic Garden.

3.—A quantity of Melon seed. From Colonel J. Haughton.

Colonel Haughton writes, that this melon seed was given to him by an Affghan, who said he brought it from his home near Ghuznee. The seeds which he (Colonel H.) has sown have vegetated. Before being sown, the seeds should be well washed to clean them of mucilage, or they are apt to rot.

(Available to Members, early application recommended, as the time for sowing is nigh at hand.)

4.—Seed of a beautiful gigantic white rose. From Lieutenant J. F. Pogson.

The following is extract of Lieutenant Pogson's letter, dated from Simla, 31st January:—

"Thinking that many Members of the Agricultural and Horticultural Society would like to send their friends in England some seeds of the beautiful gigantic white creeping rose of these hills, I have this day despatched to your address a small banghy parcel of these seeds.

"They were gathered off two Pine Keloo (Cedrus Deodara) trees fully 70 feet in height, and when in flower, they gave these trees the appearance of an immense bouquet, which perfumed the air for a considerable distance.

"Small packets of the seed if sent home in overland letters, would reach England in ample time for sowing in spring. But to ensure their germinating, the sooner they leave India the better. These seeds were gathered eight days ago, and are quite fresh."

(These seeds should also be applied for immediately.)

5.—A sample of indigenous cotton from Assam. From Major T. Pollok.

Major Pollok writes thus regarding this cotton:—

"I sent you down a few days ago a small parcel containing some pods of cotton I picked out of a field off the stalks near Tikri Kella, pergunnah Michpara, and belonging to the Luckenpore Rajah, near Goalparah. They struck me as being very fine ones, so I send them; but as my experience regarding cotton culture is *nil*, I may be altogether wrong."

Mr. J. M. Ross (a member of the Committee) offers the following remarks regarding this cotton:—

I have heard a good deal about this Assam cotton, but have never before seen it in the pod. The quantity of cotton in a pod exceeds that of almost any other quality of which I am acquainted, except occasional selected pods, which I presume these are not. The cotton is harsh and staple of the shortest, but from the strength of the fibre and its really good color, I consider it an article of some value. It would probably sell lower than any cotton imported into Great Britain on account of its inferior staple, but I think in the present state of the home market, it would be worth 5¼ to 5½*d.* per ℔ if well ginned and free from stained cotton, or, say, ½ to ¾*d.* per ℔ below "Fair Bengal." It is of a quality which would find ready sale here, at probably Rs. 15 to 15-8 per bazaar maund.

Irrigation by Wind Power.

Read the following letter from Mr. H. A. Harris, of the Bengal Marine, dated 16th February, in continuation of his previous letters on the subject, as published in the Proceedings of August and October last:—

"I have now much pleasure in sending you a windmill pump complete, and I hope you will give it a good trial in a clear open spot.

The pump now sent is more adapted for a large garden, tea or indigo plantation, &c., than for common native use, it being rather expensive. I am still engaged in trying experiments to determime the cheapest and best form of wind pump for the use of ordinary ryots. Any assistance the Society may be disposed to grant towards that object will be most acceptable.

"The present model is made with an old boat pump, and the wood work is very rough, the crank and revolving head are, however, of the best wrought-iron, and I have no doubt but that you will be able to judge of the capabilities of wind when thus applied. The hose and sail cloths should be removed when the pump is not required, to prevent accidents from sudden squalls, and the whole of the iron work should be lubricated occasionally to prevent rust.

"A Warner's patent pump is the best adapted for wind power. The following is an estimate of the cost of a wind pump up at Chittagong on Mr. Fuller's garden, and which he is very sanguine will be most useful during the ensuing hot weather. A report on its working will be sent me.

	R.	A.	P.
Warner's 2½ inch Patent Pump	25	0	0
Revolving head, crank, &c., lathe turned ...	50	0	0
Wood work, about	25	0	0
Iron piping, at 12 annas per foot	15	0	0
Contingencies	5	0	0
Total Rs.	120	0	0

" The sails are set to an angle of 20°, which I find sufficient for ordinary work; one of them is weighted to assist the up stroke of the pump.

" A slight push is sufficient to turn the sails to the wind. The present ones will work the pump in a moderate breeze, but larger ones might be applied in very light winds, and smaller ones in strong monsoon gales, or the sails cloths could be reefed.

" A similar pump has been successfully used on board a ship. One saved the "Royal Visitor" in a gale of wind, and in the course of my surveying duties, I have seen hundreds of places where it would have been most useful, especially in Orissa.

" I shall be most happy to assist any one who may wish to fit up a wind pump, and any suggestions for an improved one will be appreciated and tried.

" The favour of a report on the subject (after trial) is requested."

Resolved. That Col. Wintle be requested to give this windmill pump a trial, and communicate the result to the Society.

PROPOSAL FOR A SILK FARM IN BENGAL.

Submitted the following remarks from Mr. G. DeCristoferis on the above subject:—

" I have to thank you for the copy of the Proceedings of the Society of the 21st ultimo, which you forwarded to me. Captain Hutton in his letter on Sericulture in Bengal, which appeared therein, has condemned in so peremptory a manner the usefulness of establishing a silk farm in Bengal, and upholds on the contrary his views of having the farm established in Mussoorie, that a few more remarks on this matter may not be uncalled for, to clear some points which appear as yet in the dark.

" In proposing to establish a silk farm in Bengal, I was far from supposing that it would have been sufficient to supply seed-cocoons within easy reach for all the demand of the country. But if the farm had been in the course of time successful enough to pay itself, or offer little loss, branch farms may have been established in other districts, rendering therefore the benefits of the system more general.

" It is admitted also by Captain Hutton that the present method of rearing the worms adopted by the natives is deficient in many respects. Would not, therefore, the adoption of a sound and practical system, and particularly the careful choice of cocoons for seed (to which the natives pay little or no attention) tend of itself to improve the polyvoltine species so generally reared in Bengal? The farm locally established would not only do this, but show the natives the way of doing it themselves. And as regards the introduction of exotic species, I think that experiments would be more practical, and to be depended upon when made in the locality where they are meant to be adopted.

" But the strong argument in Captain Hutton's veto for the establishment of the farm in Bengal seems to be, that as the worms cannot be reared upon the trees in the open air, it is perfectly impossible to improve the polyvoltine in Bengal.

Rearing silk worms on trees in the open air is certainly according to the law of nature, but where nature fails, art has taken its place often for the best in both animal and vegetable life.

"The silk worms imported and reared in Italy and France since centuries produced previous to the last disease (the Atrofia) the very best cocoons known, and this was owing to the careful and intelligent treatment of them, being reared in rooms kept occasionally warm with artificial heat, and ventilated as may be required. From what ill influence the European crops (and of other countries) have lately failed, and whether the disease is in the worm or the mulberry plant, is a question that science has not yet cleared up.

"A trial to rear on trees in the open air, but on a small scale, and for the purpose only of obtaining cocoons for seed, may be made also in Bengal during the cold season; when we have neither to fear too powerful a sun, nor the damages that may be occasioned by gales or rain.

"It is now a question whether by establishing a farm in Mussoorie, it is intended to reproduce there the cocoons for seed only from the original stock sent from Bengal. In this case it is likely that the polyvoltine species, in a much cooler climate, may be greatly retarded and become bivoltine or trivoltine, and how is this to be avoided? I would further ask how often during the year can mulberry be cut in Mussoorie, and how we are here in Bengal to depend upon the arrival of the eggs in the time they are wanted. There in summer eggs will hatch after seven or eight days of being deposited. Would not this create another difficulty? Before closing this letter, I wish to record from my old notes, an experiment I made as far back as in February 1857, of rearing here some China cocoons from eggs that I received direct from there.

"The eggs were partially hatched when they reached me, and continued hatching very irregularly in the same way as do the eggs from Japan.

"In the first two stages these worms had not a very healthy appearance, but became more promising as they advanced in age.

"The education of the worms was rapid. It begun on the 16th of February, and food was plentifully given, and on the 10th of March they began to spin the cocoon without showing signs of prominent disease. I reeled a portion of these cocoons; they unwound well, even without ovening, and the yield was a seer factory weight of silk from kahun 5¼ of cocoons (a kahun numbers 1280 cocoons), whereas with the Japanese cocoons which I reared and reeled here last season, it took 14 kahuns to make the same quantity of silk, which is no improvement on the best Boro Pullo, or even the best polyvoltine cocoons as far as yield is concerned.

"I may remark a curious feature of the China and Japan worms reared in Bengal, that when ready to spin they will not (with few exceptions) ascend of their own accord to form the cocoons on the twigs placed for this purpose between the trays as they do in Europe, but must be taken off the trays, and placed in the Chunderkee used in Bengal (a mat-tray intersected with narrow partitions) by

which mode several worms are picked in an unripe state often requiring a last feed, and on their spinning the cocoons, numbers of worms getting together, will give a large quantity of double cocoons, *i.e.*, a cocoon with two, and some times three worms inside."

Trial of Carolina Paddy in Assam and Midnapore.

Read a report from Mr. Richard Rowe, dated from Debroghur, Assam, 23rd January. *(See Correspondence and Selections.)*

Improvement of Wheat by selection.

Read the following letter from Mr. J. H. Bridgman of Newra, Gorruckpore, dated 21st February, on the above subject (Mr. Robertson's communication was submitted at the Monthly Meeting in May last, and Mr. Bridgman's previous letter in the following Meeting in June) :—

"I take the opportunity afforded by the remittance of my subscription to give you what information I can about my experiments in the cultivation of wheat. The little packet of Mr. Robertson's wheat which you were good enough to send me, came to grief in an unexpected manner. I left it unopened on my library table, while a little tin box was being made in which to keep it free from damp. A day or two afterwards I perceived that a little hole had been made in one end of the packet, and all the seeds extracted. It was evidently the work of a mouse, and was the first indication I received that there was a mouse in the house. I lost therefore the opportunity of trying what result could be obtained from sowing Mr. Robertson's improved grain. With respect to my selected ears of wheat, measuring from 3½ to 4¼ inches long, I think I may venture to hope that a great success has attended the experiment. The seeds were purposely sown in quite a medium soil, with little manure, my object being to obtain a variety which owed its increased length of ear to nature only, and not to high culture. They were sown with the spade and unfortunately, in consequence, sown too deeply, by which a great deal of the plant was lost; but of those plants which have come up, I find all the ears of the same unusual length as those of the parent grain. Some indeed are longer. I find a few which measure 4¾ inch in length, which is ½ an inch longer than any which I selected. I find it difficult to conclude that this can be the result of accident rather than selection. At any rate it affords encouragement to go on with the same course of experiment.

"You referred in one of your letters to my own and Mr. Hall's efforts to obtain a better kind of wheat many years ago. The most promising among a great variety of seed which you then sent me, was that bearing the name of "Polish wheat." The grain was hard, but of singular length. I cultivated it successfully, and obtained a large store of it, which I purposed distributing among my tenants. Unhappily, an assistant in my employment, acting in my absence, under some strange misapprehension of orders, sold the whole of it in the bazaar without

leaving a single grain. But I find that, though this happened some 24 years ago, the wheat has not been forgotten, for a native zemindar inquired for it last year, describing it with so much exactness, that it could not be mistaken. He was very desirous of getting some of it to sow. If it can be procured, I should be very glad to renew the attempt to propagate it."

Resolved. That a small quantity of the "Polish wheat" referred to by Mr. Bridgman, be imported for next season's sowings.

MODE OF DESTROYING THE COTTON BOLE WORM.

The Secretary next read a letter from Mr. G. H. Kearney, of Bholee Indigo Concern, Etawah district, dated 27th January 1871 :—

"The Cotton Bole worm that attacks New Orleans cotton most particularly, is an animal so destructive to the interest of the cotton grower, that I simply place the result of my experience at the disposal of those labouring in the same field of such magnitude and interest both to England and to India.

"The worm is a screw-bodied white one, with an awl-shaped head, and his practice is to steal up from the root of the cotton plant to the pod or bole, and getting a leverage from the calyx or leaves that suround the bottom of the bole or pod for his body, he bores a hole, making a snug retreat supplied with food for himself, leaving no cotton for the laborer "Homo."

"After many varied trials, results being failures, I trust it will now be acknowledged that the animal is simply out-manœuvered, for by removing the leaves that gives his body leverage, he can only stay a short time on the pod or bole, and then falling off, he tries again and again with no better results and as a consequence dies from starvation and want of shelter.

"It must be borne in mind that the bole worm does not present himself every year, and so the removal of the leaves at the bottom of the pod should only be when some of the worms have appeared.

"The removal of the leaves—to outwit this little destroyer of human labor—would not exceed one rupee per acre, for children could easily do it as also women."

Letters were read—

From Lt. J. F. Pogson, suggesting the introduction of new varieties of potatos into the hills to replace the present worn out stock :—

"I am sorry to report that this year's Mahasoo (Simla) potatos are more or less diseased. Though fine to look at, when boiled the inside shews green and dark spots, and are quite unfit to eat.

"I fear that, unless some active measures are taken this year, that next October's crop will be a perfect failure, and then the European troops will suffer much inconvenience from want of this valuable tuber. I believe Generel Tapp introduced the potato into these hills some 35 years ago, and the crops having been raised year after year from the same seed, generally grown in the same field, has at last degenerated.

"The Bunneahs have managed to get this (potato) cultivation almost entirely into their own hands, and as not one of them would expend a sixpence for fresh, sound seed, the destruction of the potato crop becomes a mere question of time. Carter and Co. of London, have introduced some very superior, and one splendid variety of potato into England. But as yet I do not think any of them have been sent to India."

Agreed, on the recommendation of the Council, that a sum not exceeding Rs. 200 be disbursed for the purchase and despatch of the best descriptions of potatoes procurable from the Hooghly District.

From Col. Horace Brown, Dy. Commissioner, Thayet Myo, in reference to an application for eggs of the species of Burmese silk worm alluded to in his paper published in a recent number of the *Gazette of India.* Col. Brown intimates the mode he proposes to adopt to meet the requisition of the Society and other applications, and send, in the meantime a small quantity of eggs which reached a few days ago, but unfortunately all hatched *en route*, and not a single worm reached alive.

From the Secretary, Cape of Good Hope Agricultural Society, acknowledging receipt of silk worm's eggs (*Bombyx textor*), which reached in good condition, and of the last published number of the Society's Journal. "Captain Hutton's interesting paper on silk culture in Australia, contained in this Number of your Journal, is valuable to us, the climate of that country being about the same as ours. I transmit herewith a copy of our last Annual Report, from which you will glean what we are doing. Sericulture is entrusted to a separate commission, but we work hand in hand to attain our great object."

From F. Halsey, Esq., Umritsur, in respect to the lettuce seed forwarded last year by Major James Williamson from England. Mr. Halsey reports that it germinated freely, and that its produce has turned out remarkably good; it is a cos lettuce.

From the Secretary, Board of Revenue, applying on behalf of the Madras Government for a model of a rice hulling machine, similar to that in the Society's museum. Complied with.

From Secretary to the Chief Commissioner of Mysore, enquiring where seed of the best Havannah or Shiraz tobacco is procurable with a view to its experimental cultivation in the province.

The Secretary intimated he had sent a quantity of Havannah seed, and suggested the steps to be taken to procure a further supply.

From Messrs. D. Landreth & Son, Philadelphia, acknowledging receipt of order for this year's seed, to which they will give early attention so as to ensure its arrival in all April—May.

From Messrs. Law, Somner & Co., Melbourne, order for field seeds acknowledged, and best attention promised to it.

Mr. Archibald Rogers submitted a Hyacinth and a Cyclamen, both in flower; Mr. W. H. Cheetham shewed *Ferraria undulata* in bloom (a bulbous plant from the Cape of Good Hope); and Mr. W. Pigott exhibited some good specimens of cut Pinks, raised from English seed.

For the above communications and contributions the best thanks of the Society were accorded.

Thursday, the 23rd March 1871.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Monthly Meeting were read and confirmed.

The following gentlemen were elected Members :—

Honorary Member—Baboo Peary Chand Mittra.

Ordinary Members—Lieutenant G. M. Rogers, Major T. M. Shelley, Captain H. S. Jarrett, Colonel J. Gordon, Messrs. G. L. Calder, James Murdoch, J. T. Rowett, J. W. O'Keefe, James Sutcliffe, J. M. Comley, Dr. James Wise, and Lieutenant-Colonel H. Mills.

The names of the following gentlemen were submitted as candidates for election :—

William Willson, Esq., Indigo-planter, Bansghat, Chupra,—proposed by Mr. W. R. Brown, seconded by the Secretary.

Captain W. Siddons Young, Commanding at Chunar,—proposed by the Secretary, seconded by Dr. R. H. Perkins.

Colonel H. H. Maxwell, R.A., Superintendent, Gun Foundry, Cossipore,—proposed by Mr. Crawford, seconded by Mr. T. H. Wordie.

Nawab Fyz Ally Khan Bahadoor, Jeypore,—proposed by Baboo Peary Chand Mittra, seconded by the Secretary.

Brigadier-General A. Macdonell, C.B., Commanding Rohilcund District,—proposed by Captain H. H. Birch, seconded by Mr. Crawford.

Lieutenant-Colonel H. Templer (Staff Corps), Bareilly,—proposed by Captain Birch, seconded by Mr Crawford.

W. O. A. Beckett, Esq., Deputy Commissioner of Cooch Behar,—proposed by Colonel J. C. Haughton, seconded by the Secretary.

Major John Macdonald, Survey Department,—proposed by Dr. Tonnerre, seconded by Mr. Crawford.

F. Rodriguez, Esq., Calcutta,—proposed by Dr. G. R. Ferris, seconded by the Secretary.

The following contributions were announced :—

1.—Correspondence respecting the cultivation of Silk in Sydney,—from Dr. George Bennett.

2.—Selections from the Records of the Government of Bengal, Public Works Department, Irrigation Branch, No. 1, regarding Damooda Canal Project, and Records of the Geological Survey of India, Vol. 4, Part I. From the Government of Bengal.

3.—The *Flora Sylvatica* of the Madras Presidency, by Major Beddome, Part VI. From the Government of India.

4.—Monthly Report of Department of Agriculture, United States of America, for November and December 1870. From the Hon'ble N. P. Jacob.

5.—Report on the Royal Dover Garden, Port Blair, by Dr. J. B. King. From Colonel Man, Superintendent of the Andamans.

6.—Journal of the Asiatic Society of Bengal, Part I., No. 4, 1870. From the Society.

7.—A small quantity of indigenous Tobacco seed. From Lieutenant J. F. Pogson.

8.—Various samples of Tobacco raised at Dharwar in the Bombay Presidency. From E. P. Robertson, Esq., Magistrate and Collector of Dharwar. (Referred to the Committee for report.)

(Full particulars regarding the above seed and Tobacco will be found in the body of the Proceedings.)

9.—Several fine specimens of Maize, Cholum, Carolina Paddy and other grains. From Major O. T. Burne.

Major Burne writes that these are the produce of the Government Model Farm at Madras, and are forwarded by His Excellency the Viceroy for the inspection of Members. His Excellency also sends some seeds of the different kinds for trial.

(This fine seed is available to Members who will undertake to communicate the result of their sowings.)

Portrait of Mr. Grote.

The Secretary drew attention to the above portrait, which had been received since the last Meeting and placed in the Hall. This portrait of the late President, which was pronounced a good likeness, is the result of the resolution passed at the Monthly Meeting in August 1868.

Essays on the Cultivation and Manufacture of Tea.

The Secretary announced the receipt of eleven essays on Tea culture and manufacture from Assam, Cachar, Darjeeling, Dehra, Kangra and the Neilgherries, which had been sent in to compete for the prize offered last year. Those from Assam and Cachar had already been referred by the Council to a Committee to report thereon. A Committee for examination of the others had not yet been selected.

Horti-Floricultural Exhibition.

Submitted the following reports of the Judges on the Show, held at the Metcalfe Hall, on the 23rd February :—

Horticultural.—The collection, both of vegetables and fruits, was not equal in quantity and quality to former years. The Asparagus was very poor. Artichoke good. Of the *Brassica* tribe, the Brocoli was good considering the lateness of the season; of Cauliflowers there were a few good samples; all the Cabbages (Sugarloaf, Savoy, Early York) showed well; only one good specimen of Scotch

Kale was exhibited. There was a tolerably good collection of Turnips. A very good collection of Knolekole. Some of the Celery was excellent, others indifferent. Carrots, Beet and Onion all good. Endive, middling. Lettuce poor. Of Peas the collection was limited, but good, and Spinach the same.

In the fruit department there were some good Baels, Guavas, long Plums, Papeeyas and Pineapples. Sapotas and Pomegranates very good.

About one hundred *malees* competed, and prizes to the amount of Rs. 252 were given, according to the annexed list.

CHARLES FABRE TONNERRE,
W. STALKARTT.
PEARY CHAND MITTRA.

A sample of Havannah Tobacco grown at Tangrah on the lands reclaimed by the Justices with the sweepings of the town was exhibited by the Health Officer. The Tobacco is well grown, the leaf very fine and soft, and the mode of curing it excellent. The Tobacco deserves a special mention, though not included in the list of the plants which were allowed to compete for prizes.

CHARLES FABRE TONNERRE.

Floricultural.—The display on this occasion was small as compared with previous years. The collection of Roses was especially poor and limited; the produce of two gardens only instead of 10 or 12, as in former years. There was a fair display of Camellias, but all of the white flowered variety. The collection of Heartsease was larger than usual, including several good specimens. Some fine plants of *Franciscea*s were shown, and two good examples of *Cobœa scandens*. The collections of *Petunias, Phlox, Portulacas, Verbenas, Oxalis* and *Begonias* were tolerably fair. There was a large display of *Coleus*, a few pots of *Campanulas* and double Larkspurs. The collection of Ferns was larger than usual, including a fine Tree Fern from Cachar.

Among the few novelties, were several plants of *Clianthus Dampieri*, in flower, from the gardens of Baboo Heraloll Seal, Dalhousie Square, and Rajah Suttyanund Ghosal; of *Cyclamen* and Tulip, from Mr. A. Roger's garden; a speckled Amaryllis from the Hon'ble J. P. Norman; *Anœtochilus*—————? (in flower) from Mr. J. A. Crawford's garden; two fine examples of Ivy from the garden of the Hon'ble E. Jackson; some Lantanas (French Hybrids) from Mr. G. Bartlett, and a plant of *Aristolochia saccata*, from Darjeeling, from the Royal Botanic Garden.

From the Royal Botanic Garden came a fine collection of plants of various sorts, which added much to the beauty of the Show.

On the day following the Exhibition, a splendid large plant of *Clianthus Dampieri* was received from Mr. A. Murdoch from his garden at Serajgunge. Though this plant arrived too late for competition, it was deemed so superior to those submitted on the previous day, that an extra prize of Rupees 10 was awarded to it.

The produce of 20 gardens was submitted, and prizes to the amount of Rs. 155 were awarded to the *malees* of 15 gardens.

JOHN SCOTT.
G. W. BARTLETT.
J. LYNAM.

PROPOSAL FOR A SILK FARM.

Read the following rejoinder from Captain Thomas Hutton, to the remarks of Mr. G. de Cristoferis, submitted at the last Monthly Meeting:—

"As to your friend Mr. Cristoferis, his best plan will be to establish a small Silk Farm of his own, and he will then soon practically learn that all I have said is simple truth; indeed, he proves it by showing his own failures with his Japan worm, and the other importation from the same locality, the name of which species he seems unable to give; the separated eggs of his Japan worm are now hatching, but very irregularly still. There is probably still something of the cross left in them. As, however, my opinions do not appear to be received with much favor in Bengal, by all means induce the Government, if you can, to establish a Silk Farm there; I do not say that no improvements could be effected, because I have frequently pointed out that, under an improved system of treating the worms, some good may possibly be effected; but then my system would be to abolish the practice of feeding the worms with watery *cuttings*, and give nothing but sound ripe leaves as is done in Europe. Mr. Cristoferis acknowledges that the *natural* system would be to rear the worms on the trees, but that in Bengal it could not be done; this at once proves that the climate of Bengal is *not naturally suited* to the constitution of the worms, while the climate of Mussoorie is so. You must bear in mind that all your species were originally from the north of China and its neighbouring Islands, and common sense alone is sufficient to show that such species could not be expected to give the same results in Bengal as in their native climate. All your work must, in a measure, be done on artificial principles, from which, although profit may be derived, yet it can never equal that of the parent country.

"There is no reason why you should abandon Silk culture if it pays, merely because in Mussoorie and in China the worms thrive better. So long as your returns warrant the cultivation of Silk, by all means continue your operations, but do not feel disheartened because better results can be obtained elsewhere. As to teaching a pig-headed Bengali ryot to improve his system, you may as well try to teach the monkeys, for if an improved system entails the least additional expense they will not adopt it. It may, doubtless, be true that one farm at Mussoorie will not give all the results required by Sericulturists; but the question is, whether other farms will succeed better? I think not, yet I may be mistaken; therefore, see what you can effect in Bengal."

Exotic Tobacco Cultivation at Dharwar.

Read communication, dated 20th December 1870, from Mr. E. P. Robertson, regarding the samples of Tobacco referred to above. *(See Correspondence and Selections.)*

Indigenous Tobacco of the Himalayas.

The Secretary next read the following remarks from Lieutenant J. F. Pogson regarding the tobacco, of which a quantity of seed has been sent and already noticed under the head of Contributions :—

"I have the pleasure to enclose half a tolah weight of wild Himalayan tobacco seed. The plant is a perennial, stands the severest frost, hail and snow, is always in leaf and in flower from August to March. In appearance it is very like the Virginia tobacco plant, especially the leaves. But it reaches a height of over eight feet (but under 9) and is an evergreen; further, the plant only dies when pulled up by the roots. The seeds sent were gathered from plants which I know to be seven years old.

"This tobacco grows in such out-of-the-way places on rocky soil that the only way for accounting for its presence is the assumption that small birds have fed on the seed and passed them undigested, just as they do seeds of the Peepul, Bair and Guava. The paharees do not cultivate the plant, neither do they use its leaves as tobacco. The reason given is that it has no strength.

"I think if cultivated it will produce very good tobacco. It is quite unreasonable to expect that the numerous mineral matters, and peculiar substances present in carefully cultivated tobacco, can be evolved out of the poorest of poor soil, hence the want of strength complained of. I would suggest that this seed be sown in beds, and then be planted out on lands reclaimed by means of sewage from the salt water lake. If it succeeds Bengal will possess a new crop, inasmuch as an acre of land under this tobacco, will give perhaps four or more crops of leaves per annum, and being a perennial all the expenses of annual cultivation will be saved. I can supply more seed if needed.

"I for one do not believe that tobacco is an exclusively American plant, and my reasons are founded on the fact of their being Sanscrit and Hindi words, over 2000 years old, for articles connected with tobacco. Thus we have "Naus," the *Sanscrit* for Snuff; "Naryul," Sanscrit, for the "Hubble-Bubble;" "Gutta," Sanscrit,—that part of the wood pipe which is fixed into the orifice made in the cocoanut, and having the chillum at its upper end; "Mookh-Naul," (*Vulgo*, Moonal) two Sanscrit words meaning mouth-tube or pipe (*Anglice*, mouth-piece); "Chillum," Hindee, the clay bowl which contains the tobacco and fire. Now I submit that the Aryan race who spoke Sanscrit could not have had words for things unknown and, therefore, that they knew all about smoking ages before the discovery of America. Probably *Naus-Putta* was the Sanscrit for tobacco plant and leaf, just as "Bhoje putta" is Sanscrit for *Birch*, and *Birch* bark as well as

this substance is mentioned as being used in the manufacture of the flexible hooka pipe or snake; so you see Sanscrit carries the day by a long chalk.

"I know a very superior kind of tobacco grown in Thibet, and small quantities are brought for sale to the Rampore fair, and the tobacco pouch and metal pipe of Thibet are, if anything, older than Budhism.

"In conclusion, I would wish to draw attention to the fact that extract of Taraxacum sells up here at the enormous price of Rs. 16 per pound, and that if the seed of the "Leontodon Taraxacum" was imported from France, every Tea Planter in India might grow this most valuable plant, most improperly looked down upon as a weed. The method of culture is very simple.

"Taraxacum Coffee is one of the most valuable of remedies for torpid liver."

Agreed to transfer a portion of this tobacco seed to the Calcutta Municipality, and the remainder to be distributed to Members.

Tree-planting in Upper India.

The Secretary next submitted the following extract of a letter from Mr. Henry Cope, dated so far back as June 1870. He had, by desire of the Council, addressed the Inspector-General of Forests on the subject in September last, but had only recently received the following reply from Major Pearson, the Officiating Inspector-General :—

"The extension of fruit-bearing trees amongst the *people* is one deserving the special attention of your Society, and you would render the whole country the greatest service by pressing on the official community of all classes, European as well as native, the advantages that must arise to the great mass of the population from increasing the capabilities of the country in this respect. It is a fact that so large is the consumption of wood, when that is still used for fuel, that in the Districts of Meerut, Mozuffernuggur and Seharanpore, the fine old mango trees that form in groves (topes) the sole ornament of those parts, are being cut down by greedy zemindars, who thus sacrifice the past of half a century's growth and the future of hundreds of maunds of fruit for the immediate realization of a little ready money.

"This wholesale destruction has, I believe, attracted some attention on the spot, but it is difficult legally to interfere with the rights of private property. Would your Society consider it within the scope of its objects to press on the Government the consideration of some Legislative enactment, if not for the preservation of trees, at least for the compulsory planting of five or ten young trees for every old one cut down? If some stop be not put to this wholesale destruction of the principal tree vegetation of the land, fears may reasonably be entertained that the atmosphere will undergo a material and most unsatisfactory change, and that the average rain-fall will be considerably reduced. The Forest Department might be entrusted with the superintendence of measures connected with this inroad on the main barrier to the increase of heat and the proportionate decrease of agricultural produce.

" 'Major Pearson presents his compliments to the Secretary to the Agricultural and Horticultural Society, and, with reference to his note to Dr. Brandis of 17th September last, begs to inform him that it was Dr. Brandis' intention to have drawn up a report as to what had been done by the Government of India to check the indiscriminate destruction of trees in some parts of Upper India' as referred to by Mr. Cope in his letter to the Society, extract of which was forwarded with his letter.

" 'In Oudh, and in some parts of the North-Western Provinces, the land revenue, it is believed, is partially remitted on lands covered with groves. In the Central Provinces large sums are annually spent in planting trees, but hitherto, except in some cases, the operations have not been very successful, as the climate militates very much against the establishment of trees without they are constantly watered, and this is a most expensive operation. In Berar, revenue is remitted on land covered with plantations, but, as under the ryotwaree system of land revenue, the trees after 20 years become by the terms of the Settlement the property of the holder of the land, there seems no legal power of preventing their being cut down. When in charge of the Berar Forests, Major Pearson in vain entered protest after protest against the cutting down of the old village tamarind and mangoe trees to feed the cotton gins, where the wood easily fetched Rs. 25 or 30 per tree for fuel; perhaps the discovery of coal in the Wurda River may be the best friend to the groves of trees in Berar.

" 'The evil resulting from the destruction of trees has been and is constantly pointed out by the Civil Officers to the zemindars, and there can be no doubt that a District Officer who really choses to do so, may do much to prevent their wanton and unnecessary destruction, and a Circular, embodying the views of the Council, will be submitted by this Department to Government for sanction.

" 'It may be stated, however, for the information of the Council, that in the Punjab, which is the most denuded of trees of any of the provinces of Upper India, Government is now spending nearly a lakh of rupees annually by direct agency on plantations. In the North-West Provinces also a special officer has been appointed for the propagation of fruit trees at Raneekhett for distribution over the country.' "

Letters were read from Dr. George Bennett, Secretary of the Acclimatisation Society of Sydney, and from Mr. LeSouef, Secretary of the Acclimatisation Society of Melbourne, returning thanks to the Society and to Mr. C. Brownlow of Cachar for the Cocoons of *Attacus Atlas* forwarded to them, and which had reached in good condition.

Mr. John Lynam submitted several Verbenas, including two new varieties. Mr. C. E. Price the same, and a very handsome large double Petunia, a novelty. Mr. W. Pigott exhibited a *Tritonia,* "brilliant," in full flower.

For the above presentations and contributions the best thanks of the Society were accorded.

Thursday, the 20th April, 1871.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:—

Captain W. S. Young, Colonel H. H. Maxwell, Nawab Fyz Ally Khan Bahadoor, Brigadier-General A Macdonell, c.b., Lieutenant-Colonel H. Templer, Major John Macdonald, Messrs. Wm. Willson, A. O. Backett, and F. Rodriguez.

The names of the following gentlemen were submitted as candidates for election:—

J. F. Dias, Esq., Calcutta, —proposed by Mr. Arch. Rogers, seconded by the Secretary.

Colonel J. M. L. Bird, Morar,—proposed by Colonel John Eliot, seconded by Major T. M. Shelly.

The Secretary of the Satkira Agricultural Society,—proposed by the President, seconded by the Secretary.

Baboo Prosonno Coomar Banerjee, Calcutta, —proposed by Colonel E. H. Wintle, seconded by the President.

G. F. Pinney, Esq., Jorehaut Tea Co., Assam,—proposed by Mr. J. Buckingham, seconded by the Secretary.

Wm. Smith, Esq., Secretary, Bengal Printing Co.,—proposed by Mr. W. Pigott, seconded by the President.

Re-joined, Major-General W. F. Nuthall, Political Agent, Munnipore.

Mr. W. H. Cogswell and Baboo Peary Chund Mittra were elected into the Council.

Mr. T. H. Mosley and Mr. W. Swinhoe were respectively added to the Cotton and Tobacco Committees.

The following contributions were announced:—

1.—Annual Reports of the Department of Agriculture, U.S., for 1868-69, (two vols.) From the Consul-General, U.S.

2.—Memoirs of the Geological Survey of India, vol. 7, Parts 1 and 2; and of *Palæontologia Indica,* vol. 3, Nos. 1—4 and 5—8. From the Government of Bengal.

3.—Potatos raised from English stock. From Major T. M. Shelly.

4.—Capsicum seed of large size. From J. D. Gash, Esq.

5.—A small collection of Hill seeds —Rhododendron, Cupressus, Acer, and seed of *Prangos pabularia,* which yields the celebrated hay of Thibet. From Dr. George King.

Dr. King observes that this seed is saved from a plant grown in Mussoorie from seed brought, he believes, from Leh.

The above seeds and potatos are available to Members.

6.—A skein of raw silk from Burmah. From Col. H. Browne, Deputy Commissioner of Thayet Mayoo.

This silk is valued by, a Member of the Committee (Mr. George Conti) at from 7 to 9 rupees per factory seer according to quality; it is produced from double cocoons. There is no market here for this class of silk, but could be sold for Europe at the prices abovenamed.

Agricultural and Horticultural Notes.

Read the following communication from Major T. M. Shelly, of the Bengal Army, dated 3rd April, regarding the potatos already referred to:—

"At a Meeting of the Society held on the 28th February last, a letter was read from Lieut. Pogson, suggesting the introduction of a new variety of potato to replace a worn out and diseased kind at Simla.

"Having in June 1870 received a new kind of potato from Messrs. Hooper and Sons of Covent-Garden, London, bearing the name of "Climax," I have the pleasure to send by rail a few* tubers for distribution.

* Medium and small only sent.

"Messrs. Hooper and Sons describe "Climax" as a seedling of the early Goodrich, with 'a stout erect stalk, full medium height, internodes of medium length and very large leaves;' the tuber is above medium, quite smooth, in form of a short cylinder swelled out at the centre, eyes yellow, and often projecting, skin of medium thickness netted tough and white; flesh solid, white, heavy and brittle, never hollow, boils quickly, mealy, and of floury whiteness.

"One pound of these potatos gave an out-turn of one hundred and ninety pounds.

"I will now give you the result of my experience in growing the 'Climax' in the Hills and the Plains. As already stated, the potatos came from England in June last, they came by Sample Post, two only were in a planting condition. Not having a garden, I made a bed of earth against a rock at Landour, placing each potato one yard apart; knowing that half of the growing season had passed I despaired of the result. The potato halms grew vigorously, covering nearly seven feet of ground. They were taken up in the following October with a net produce of 22 lbs., some of the tubers weighing 8 ounces, thus producing a crop in about four months. I think the result is of a sufficient satisfactory nature to enable me to believe that the climate and soil of the Himalayas suit this tuber.

"Leaving the hills the latter end of October last, and not wishing to loose the potato season in the Plains, I planted some of the hill-grown produce in my garden at Morar, using only the ordinary garden soil without compost, as the white ants are troublesome at all seasons of the year. About Christmas-day they put forth leaves and continued to grow vigorously; they were taken up in April with a satisfactory result. It will be seen that two crops of potatos have been grown in ten months.

"Messrs. Hooper and Sons, in their Catalogue for 1870, price this potato at three shillings and sixpence per lb."

The Secretary mentioned that he had sent one-half of this supply to Captain Pogson.

Read also a letter from Col. C. S. Ryder, descriptive of a successful and simple mode of propagating plants as adopted by him at Jubbulpore. *(See Correspondence and Selections.)*

Mr. F. Halsey, in a letter from Umritsur, dated 27th March, writes as follows:—

"I am happy to say that the peas are looking magnificent, and I hope to send you them in a month. You must wonder at our seasons here, but we had 5 degrees of frost ten days ago. I wish you could see our gardens now; we have enormous masses of double stocks and double wall flowers,—Pansies in the open ground as large as five-shilling pieces and roses just coming out. I have a 'Maréchal Niel' the most glorious of yellow roses, with over a hundred blooms on it. The corn crop is a bumper one, immensely over average, and an enormous breadth sown; the price just now is 26 seers per rupee, but when the new crop comes in it is expected to fall to rupee 1 per maund, rather different from this time last year when it was Rs. 4 per maund. But after three years of famine, we deserve it."

In a subsequent interesting letter of 9th April (of which the following are extracts), Mr Halsey shows the beneficial effects of deep ploughing, the success attending their annual cattle fairs, &c.:—

"To show you the effects of deep ploughing (I am not quite sure that I have not mentioned this before), I would mention that this year, or rather last September, I sowed a piece of land with carrot (country) using only half the amount of seed that the zemindars do. The land had only been ploughed once with Statkartt's plough, and side by side with the land I farmed was another field of carrots sown on the same day as mine, but ploughed eight times with an ordinary native plough. My carrots were ready for consumption a full month before the zemindar's; his were two inches across at the head by six inches long, mine averaged eight to ten inches, and many were 12 and even 14 inches across and a foot long.

"A European who *rents* land in these parts has literally no reason to use manure if he will employ an English plough, as at ten inches deep he turns up maiden soil: you have only to change your land every year. Our spring cattle and horse fair are just commencing; they are held at distinct places, however; the cattle fair is one of very old standing, having been held twice a year for a hundred years or more before ever an Englishman was thought of in the Punjab. The horse fair is of our getting up, but it bids fair to be as important as any in the country. At both prizes are given;—at the horse fair good prizes were always given, but when I first came here I found they used to distribute about Rs. 500 only among many thousands of animals, and with no system of any sort; but, I am glad to say, that has now been changed, and Rs. 1,800 was distri-

buted, in handsome prizes of Rs. 100 and Rs. 50 each, among the cattle; the same amount is to be distributed now.

"Government permits a small fee of 1 pie in the rupee to be taken on all sales that take place. This is farmed out, and you will be better able to comprehend the value of the stock that changes hands at these fairs when I tell you that these fees have been farmed out for this fair for Rs. 2,500, which represents Rs. 4,80,000 worth of cattle, the farmer having to make his profit besides and keep up a large staff of servants to see that all cattle that are sold pay the proper fee. I have no doubt that the now comparatively liberal prizes will have a marked effect on the improvement of cattle in this part of the world.

"Mr. Robertson's pedigree wheat is very fine, and you shall have a full account of it when thrashed.

"I have very strong doubts whether we can improve the wheats of this country. Nothing in England would beat the wheat here this year, length and weight of ear combined with long straw. I am going to test a great number of fields this year, by weighing the contents of the Imperial bushel, and, if I mistake not, we shall find it fully up to a European standard; and I will let you know the results."

TEA CULTIVATION,—THE SITES SUITABLE FOR ITS PROFITABLE GROWTH.

The Secretary next submitted the following communication from Mr. S. E. Peal of Sapakattee, Seebsaugor, Assam, on the above subject:—

"I propose in the following to lay before you a few questions relating to Tea Cultivation, and the sites most suitable for its profitable pursuit; some relate to the present and some are of future interest.

"It may be known to you that for some time past there have been many attempts by influential bodies in England, to draw attention, through the Secretary of State for India, to the desirability of introducing Tea as a staple article of industry for India. Little enough seems to be known at home about this country or Assam, and still less about Tea.

"From the nature of the case, much money has to be sunk before it is always possible to ascertain whether Tea will pay in any given locality, and this is one where special care is needed and past experience of value as well as failures due to past oversights.

"In 1823, Tea was first heard of as indigenous in Assam in 1824, leaves, seeds and some hundred plants were sent to the Botanical Gardens, Calcutta. For some reason or other Dr. Wallich (I believe) pronounced them not to be "Tea," and maintained this for some six or seven years.

"In 1832, Lord Bentinck deputed Captain Jenkins to examine and report on this question, and aided by Lieutenant Charleton, he settled it as true, that Tea was indigenous. Two years later, 1834, Government determined to introduce to this

province, the China variety of plant, which we may now deplore, as it bids fair to exterminate eventually the fine indigenous kind. In 1836, China plants arrived.

In the above, we may notice that it took years of discussion ere it was conceded, we had Tea here at *all*; and that after all, the most inferior kind was largely introduced and propagated.

During the discussions that followed, as to the most suitable localities, it was constantly asserted that an elevation sufficient to ensure *frost* in winter, was a necessary condition of success, and so deeply was this ingrained that it lasts to our day. Hill-land was sought for everywhere. Teelas planted where cultivation was out of the question, or the entire surface soil would wash off and where difficulties of transport were at a maximum; all this, too, when it is patent that flat or slightly rolling land can be far better worked and cultivated, and now seem to pay equally well or better.

Tea may perhaps be traced to Kumaun from the fact that one of the Tea Commissioners was Dr. McClelland, Resident Surgeon at that place.

Questions of soil and climate generally were attended to; but one branch of the latter subject almost entirely omitted, and which, except among Planters, is even now almost ignored; *i.e.*, the amount and *steadiness* of rainfall.

No matter how we may plant, prune or cultivate, if we do not get rain the crop will fail. Eighteen hundred and sixty-nine gave us some cases of this, and the spring of 1870 is a fresh case in point, where serious results followed the drought.

To most of us in Assam, this was an unusual affair though not so to others. In the North-West and other places where rain falls late, and more sparingly, the number of "flushes" of leaf are known to be far fewer than here, varying from 6 to 10 or 12 in some parts, and from 5 to 15 about Darjeeling even, while in Assam it is 20 to 22, which is most noteworthy.

We here get three flushes per month, while at Darjeeling and in North-West they get often but one—see *Agricultural Gazette of India*, Sept. 15th, 1870, &c.

Tracing the matter back, we find that at first there were said to be only four pluckings (or flushes) per season, the 1st in April, making Pekoe; 2nd in June, making a coarser kind; 3rd in August, making Souchong; and 4th in October, made Congou.

As time went on, the trees were pressed harder, and yielded oftener, in some places now yeilding 8 pluckings, and where climate is most suitable up to 20 with profit.

It must be borne in mind that the *total* annual fall of rain will not indicate, the most suitable area for Tea growing. Many parts of India have a heavy annual fall down in a few months and with long droughts before and after. What is needed, is a steady monthly fall from, say, March till October, and it will be seen from Sir Charles Lyells' Principles of Geology, Dr. Hookers' Himalayan Journal, &c., that Eastern Bengal peculiarly fulfils these conditions.

The S. W. Monsoon passing over the Indian Ocean and the Bay of Bengal, becomes heated and charged to saturation with water, which it retains while traversing the lower tracts of land, until on the west side it impinges on Rajmehal, and on the Eastern flank against the Kassia and Garrow hills, where being deflected upwards into a colder strata it precipitates water copiously.

Where no hills occur, as on the Calcutta line, this water-charged wind goes on till reaching Sikkim where meeting an obstacle, and rising, it is cooled and discharges rain so freely that it makes Sikkim the "*wettest* part of the Himalaya."

It may be borne in mind that rainfall can be in excess, as at Cherra Poonjie, where the entire surface soil is so generally denuded.

In no other parts of the peninsula of India, can these conditions of steady average monthly rainfalls be found, combined with suitable temperature and soil ; and this leads me to consider Assam, Cachar, and lower ranges of Sikkim as really the only portions of this country *peculiarly* suited for "Tea," as a staple.

In the North West, in Bengal, and other places, Tea will grow, but that it can be carried on *profitably* I very much doubt.

A collateral branch of this subject is the question of how far Forest affects rainfall; Dr. Hooker says that the relative effects of rainfall on forest and this again in return on the rainfall, are difficult to separate, as they act reciprocally, and undoubtedly *part* of our very "moist climate" is due to this cause, and how far it might be affected by extensive clearings, is impossible to say with certainty.

It is usually regretted that with such fine soil and climate, Assam is such a huge "jungle," and that it is not opened up and cultivated extensively, while all the time it is possible that this *apparently* desirable object if attained might cause the ruin of the province, for more than one reason; and that as these jungles disappear, so may, to a great extent, the "fine growing climate," leaving us like lower Bengal.

This is a point on which all are more or less interested—Government, Planters, and Ryots. Last spring, the latter suffered severely in many parts by the drought, as the land was too hard to plough till late in season. If it is once seen generally that north east Bengal is *par excellence*, the future "Tea province," there will be as great a rush for land as of old for these forests, necessitating perhaps other *new rules*: unless the Government are prepared with sound arguments demanding forest conservancy, over and above those used by the Forest Department on account of timber. Grass land is here in abundance, (fit to grow Rice) there are many thousand acres of uncultivated "Potar" as it is called : the native population could easily be quadrupled adding to the prosperity of the valley; and grass jungle has little or no influence on rainfall.

There are reasons why the hills surrounding us need as yet no particular attention as to restriction in clearing forest, for as long as they are inhabited by the present races, "Jooming" will be more or less a *necessity*; and thus some 90 per

cent, of their area will be tree jungle. It is the attempt to render the plain of Assam a "fine open country," we must attend to. With regard to forest conservancy (as a principle) Assam is a most promising tract. It is especially suited for India Rubber of which there are several kinds (11 or 12 "Bors" and some 40 Ficus) Teak, Sal, Sissoo, and many kinds of timber not yet known, and the preservation and propagation of which alone, to the exclusion of the host of useless timbers now on the list, would seem the soundest policy.

Large tracts on the banks of the tributary rivers as near the hills as possible could be reserved and laid out in forests of the various timbers worth growing,—as yet little has been done, of necessity. The forests generally, however, seem greatly overrated as to value of the standing timbers, and the attention of the Department might profitably be directed more to the future than the present; and at the same time that large future supplies of timber are secured, a general denudation be avoided. I may here remark that the really *workable* Tea area in the province is far smaller than is generally supposed. To a casual traveller, extensive tracts may be shown as Tea land both in the plain and on the hills around, while to one in search for land it often turns out very limited. Patches of forest may be seen which, on close scrutiny, will yield but 1 or 2 per cent of land safely above flooding level. In the hills, thousands of acres can be seen, out of a tenth of which alone could a "crop" be *transported*, and if steep, *cultivation* is impossible any where.

As regards irrigation, to which some writers point for the cure of drought; it is doubtful, first, if it can be done; secondly, if done, whether it would be effectual. A writer in the *Englishman*, Oct. 12th, 1870, says—four or five men could irrigate eight acres per day. Let us compare this with ordinary rainfall. We here get about ·25 of an inch per day, which on a garden of 200 acres equal some 5,000 tons of water. I doubt very much our ability either to lay this amount on, or in Teela gardens to find it *at all* during droughts; yet if all this could be laid on while the air passing over the garden was hot and dry, not a quarter would remain, but be evaporated in an hour. A *warm moist* air is what we need to force on the young shoots into leaves quickly (see Lindley), the air to be near the point of saturation so as to check evaporation, while the heat forces the growth. So that I doubt the advantage of irrigation, with a dry air and hot sun shining as is usual in droughts.

In conclusion, looking at the steadily increasing demand for Indian Teas, the likelihood of recurring disturbances in China, and that Tea when carefully grown (at the right localities) will yield large profits, it is no wonder we see the attempts made to introduce it as a staple all over India; but when carefully investigated, I believe it will be found that England's future Tea garden will be Assam, and that wherever the climate is not both warm *and moist* from early spring to late autumn, Tea—though it may grow—cannot be made to do so *profitably*.

Letters were read:—

1.—From Baboo Peary Chand Mittra, returning thanks for his election as an Honorary Member.

2.—From Baboo Hurrymohun Mookerjee, submitting a copy, in Bengali, of the second part of his work on Agriculture and Horticulture, and requesting the Society's patronage.

The recommendation of the Council to award the author Rs. 50 was adopted.

3.—From Baboo Mohendro Nath Roy Chowdry, Secretary, A. and H. Society of Satkara, announcing the establishment of the Society, and requesting the co-operation of this Society.—Agreed to.

4.—From the Consul for Austria and Hungary, intimating the safe receipt of the cocoons of *Attacus Atlas*, supplied by Mr. C. Brownlow of Cachar, and requesting further information thereon.—Complied with.

5.—From C. Brownlow, Esq., dated 9th April, in reference to the above Silk worm:—

"I don't know whether I mentioned to you that I had forwarded ten cocoons of Atlas to California independently of the Society and through the American Consul, but the course he seems to have adopted is to send them to Washington where they will probably not survive if they should happen to encounter any sharp cold.

"With reference to the Atlas cocoons sent to Italy, there is a good reason for supposing that the worm will thrive in that country, which reason I ought, perhaps, to have mentioned before, at all events it is not too late now to mention should an opportunity occur to you to do so, and as an extra inducement to the authorities, to attempt its naturalization in that country. The reason then is that there at present exists in a wild state in Lombardy, or at all events in some part of the peninsula, a worm which if not the veritable Bengal Atlas is very much like it, and evidently holds a very close relationship to it. Perhaps it would be as well to find out on what this wild Italian Atlas feeds, and to try the Bengal worm on that plant. I do not think the Bengal Cocoons will burst in the climate of even Naples earlier than May or June, so that there is still time to advise the experimentalists.

"Anybody may find the wild Italian indigenous worm above referred to by looking for it among the cases of insects belonging to the Fauna of Italy preserved by dessication, in that department of the Museum at Florence devoted to this branch of science. Whether there were any details attacked to the specimen explanatory of it, I unfortunately do not remember. I am, however, certain that its place in the Museum has reference to its value as a textile material, but that it is jumbled up with other specimens without, as far as I remember, any regard to arrangement by affinities."

The Secretary stated he had sent the above extract, without loss of time, to the Consul General for Italy.

6.—From Dr. George King, presenting a paper for the Journal on pruning the Tea plant.

7.—From J. Hunter Blair, Esq., forwarding, as requested, certain printed reports on the working of the Model Farm at Madras.

8.—From Col. Man, Superintendent of the Andamans, acknowledging receipt of report on Cotton samples from the Nicobars, and promising to send larger quantities of each.

9.—From Secretary to the Government of India, Home Department, submitting a report on Cotton cultivation in the Nicobars, drawn up by the Assistant in charge.

10.—From Secretary to the Government of India, Home Department, applying for specimens of varieties of Indian Cotton, for Dr. Bernoulli.

The Secretary mentioned he had sent about forty specimens from the collection in the Society's Museum.

Mr. Archibald Rogers submitted plants of *Wigandia Vogeri* and *Hermannia*—? ; Mr. W. Pigott, a *Gloxinia* in flower—"Peguce;" Mr. C. E. Price, a geranium with pink flowers; and Mr. John Lynam a plant of *Ærides Fieldingii* in full flower.

For the above communications and contributions the best thanks of the Society were accorded.

Thursday, the 18th May 1871.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

Messrs. J. F. Dias, G. F. Pinney, William Smith, Col. J. M. L. Bird, the Secretary of the Satkira Agricultural Society, and Baboo Prosonno Coomar Banerjee.

The names of the following gentlemen were submitted as candidates for election :—

John Vernon, Esq., Executive Engineer, Debrooghur,—proposed by Mr. J. M. Wood, seconded by the Secretary.

Sirdar Bhugwan Sing, Umritsur,—proposed by Mr. F. Halsey, seconded by the President.

George Lucas Kemp, Esq., F.R.G.S., Secretary of the Standard Life Assurance Society,—proposed by Mr. E. G. Buskin, seconded by the Secretary.

John Beames, Esq., C.S., Balasore,—proposed by Mr. J. A. Windle, seconded by the Secretary.

N. M. Gasper, Esq., Pleader of the Small Cause Court,—proposed by Baboo P. C. Mittra, seconded by Mr. A. Rogers.

The Deputy Commissioner, Booldanah District,—proposed by the President. seconded by the Secretary.

Dr. David Picachy, Purneah,—proposed by Mr. J. D. Ward, seconded by Mr. J. B. Worgan.

G. H. W. Conroy, Esq., Chief Storekeeper, E. I. Railway,—proposed by Mr. Robert Roberts, seconded by the Secretary.

C. W. Odling, Esq., C.E., D.P.W., Bhadruck,—proposed by Mr. G. M. Currie, seconded by Mr. C. Toynbee.

Frederick Peel, Esq., Merchant, Calcutta,—proposed by Mr. W. H. Cogswell, seconded by the President.

Major W. A. D. Orchard, B.S.C., Barrack Master, Meerut,—proposed by Major T. M. Shelly, seconded by the Secretary.

F. R. Deverell, Esq., Calcutta,—proposed by Mr. B. D. Colvin, seconded by the President.

John Radcliffe, Esq., Merchant, Calcutta,—proposed by Mr. Cogswell, seconded by the President.

Captain W. S. A. Lockhart, D.A.Q.M.G., Morar,—proposed by Major Shelly, seconded by Col. J. M. L. Bird.

J. W. Cargill, Esq., Cossipore,—proposed by Mr. Cogswell, seconded by the President.

The Assistant Commissioner, Pachmari,—proposed by the Secretary, seconded by the President.

Falkner S. Collis, Esq., Barrister-at-Law,—proposed by Mr. F. D. Chauntrell, seconded by the President.

Dr. S. C. Mackenzie, Superintendent, Presidency Jail,—proposed by the President, seconded by the Secretary.

Baboo Shamloll Dutt,—proposed by Dr. Tonnerre, seconded by the President.

J. W. B. Skoulding, Esq., R.A., Veterinary Surgeon, Saharunpore Stud—proposed by Lieutenant-Colonel W. B. Irwin, seconded by the Secretary.

Rejoined—The Commandant of the Deolee Irregular Force.

The following contributions were announced :—

1.—The *Flora Sylvatica* of the Madras Presidency, Part 7, and *Icones Plantarum Indiæ Orientalis*, Part 7,—from the Government of India.

2.—Memoirs of the Geological Survey of India, vol. 7, Part 3, and *Palæontologia Indica*, vol. 3, Nos. 5-8,—from the Superintendent, Geological Museum.

3. —Transactions of the Bengal Social Science Association, vols. 1 to 4,—from the Association.

4.—A small supply of fine potatos from the Neilgherries,—from J. A. Crawford, Esq.—Agreed, that these be sent to Mr. F. Peterson at Simla.

5.—Seed of large and round Capsicum from seed received from the Society,—from Dr. Beaumont. Dr. Beaumont sends these seeds in response to the Society's circular.

6.—A large supply of seed of double Zinnias and Balsam, of *Ipomœa rubro cerulea*, lettuce of sorts, &c., raised in Tirhoot,—from C. E. Blechynden, Esq.

7.—An assortment of flower seeds, Larkspur, Mignonette, Balsam, Hollyhock, &c.,—from G. Bartlett, Esq.

8.—A small collection of seeds of trees, shrubs, and annuals,—from the Barrackpore Park Garden.

9.—A large supply of acclimatized Peas raised at Umritsur from stock supplied by the Society,—from F. Halsey, Esq.

10.—Fruit of the wild medicinal Bael of the Himalaya, and seed of the Dandelion,—from Lieutenant J. F. Pogson.

11.—A small sheaf of Carolina Paddy destroyed by the "Gandee,"—from J. H. Bridgman, Esq.

12.—Samples of fibre from Neilgherry Nettle and of Plantain from the Andamans,—from the Government of India. (Full particulars regarding Nos. 9 to 12 will be found further on.)

13.—A sample of Rheea-fibre, prepared by Monsieur Nagona, at New Orleans, by his patent machine, which he intends submitting to compete for the Government prize of Rs. 50,000.

This fibre is somewhat discolored from having suffered from sea water, but possesses the strength of the ordinary hand-prepared Rheea of Assam.

14.—A few ears of Wheat raised at Khaja factory, Ghazeepore, from the Pedigree Wheat presented to the Society in June last by Mr. J. G. Robertson, Assistant Settlement Officer, Meerut,—from A. J. Sturmer, Esq.

Mr. Sturmer writes that owing to heavy rain and other causes, only five grains survived, the produce of which has been 28 ears; the wheat was between 5 and 6 feet high, and the straw was very thick.

This wheat was much admired, and appears to have retained its character. It was suggested that Mr. Sturmer should favor the Society with the result of next season's sowings.

Irrecoverable Subscriptions.

The Council submitted a list of old irrecoverable subscriptions, amounting to Rs. 3,866.

Resolved—That these be written off, and that such names (27) as have not already been taken off, be now removed from the list of Members.

Fibres of the Neilgherry Nettle and Plantain.

Submitted two communications from the Government of India, forwarding samples of the "Neilgherry Nettle," and of fibre from the Plantain trees in the Royal Dover Garden, Haddo, in Port Blair, and requesting report thereon.

Read the following report from the Fibre Committee on the above samples:—

Mr. S. H. Robinson.—Neilgherry Nettle.—This is a very strong, clear, good-

colored, and well-prepared fibre, length 3 to 4 feet. It appears to have more tow, than Rhea, and would therefore probably lose more in manufacturing, but it has fine soft texture, and would, no doubt, mix well with Silk or Cotton. It is evidently a very valuable material, and should be sent to England for examination and opinion of manufacturers of mixed textile fabrics.

Plantain tree fibre.—A clean, coarse, glossy fibre, 3 feet to 3 feet 6 inches long rather irregular in strength, finer than Dhunchee, and coarser than Jute.

Mr. H. Knowles.—The fibre of the Neilgherry Nettle is very similar to the Rhea, and I should value it at about £55 per ton in London.

The Plantain fibre is very coarse and of very doubtful value. The color is good, and it might be used instead of some kinds of hemp.

Mr. W. Stalkartt.—Neilgherry Nettle Fibre is, I believe, well known as far as regards samples only, but, like the Rhea fibre, the preparation is the great difficulty.

Plantain fibre.—Manilla Hemp is made from a species of Plantain, "Musa textilis." From the bulk of the sample of the fibre prepared at Port Blair, I have separated the best, and sent a sample of Manilla Hemp to compare. In appearance it is very similar, but the Port Blair fibre is not nearly equal in strength to the Manilla Hemp, barely one-half. I would suggest that further experiments be made in the preparation, not steeping too long, and using fresh water; as if greater strength could be obtained it would be very valuable. The value of Manilla Hemp is £50 to £60 per ton. The best of the Port Blair fibre might be worth £18 to £20.

Tobacco raised at Dharwar and Julpigoree.

The Report next submitted by Dr. Tonnerre and Mr. Van Cutsem, had reference to the samples of Tobacco, which, together with the communication from Mr. E. P. Robertson, Collector of Dharwar, were laid before the Monthly Meeting of March last; and to a letter from Col. J. C. Haughton, Commissioner of Cooch Behar. Though dated 16th February, the samples had only recently come to hand. (*See Correspondence and Selections.*)

Wild Medicinal Bael of the Himalaya.

Read the following communication from Lieutenant J. F. Pogson on the above subject, dated Kussowlie, 15th April :—

" Some years ago, the Indian Government caused Bael Plantations to be formed at various stations, for supplying European and other hospitals with fresh Bael fruit. The Presidency of Madras took up the question, and at the request of that Government the Horticultural Society of India sent supplies of the finest ripe Bael fruits procurable in Calcutta to Madras. The seed extracted from this choice edible fruit was sown, and perhaps the plantations formed are now in full bearing.

On hearing of the determination of the Madras Government to form Bael plantations, I brought to its notice the fact that the Bael fruit used by me in the preparation of my Compound Bael Powder, for the cure of diarrhœa and dysentery, was produced from the wild medicinal Bael of the Himalayas. That this variety, even when ripe, was not edible, on account of its medicinal properties, and I urged that as the object in view was to provide a remedy for dysentery, and not a desert fruit for the table, the proper course to adopt was to form Medicinal Bael Plantations, in the Madras Hills, at a suitable elevation from 1,500 to 4,000 above the level of the sea. The young plants and suckers being sent from the Hurreepore* Bael Forest. The Government of Fort St. George referred the matter to some person in the Forest Department for report, and in due time it was informed that the Aegle Marmelos was perfectly well-known in Madras, and that there was no necessity for sending to the Himalayas for Bael. The fact of these being a medicinal variety was not believed, and in due time I was instructed accordingly. I was at the Hurreepore Dâk Bungalow on the 31st March, and seeing the Bael forest the Madras correspondence came to my recollection, and I resolved to gather some of the fruit and leaves for transmission to the A. & H. Society in order that the question of the existence of the medicinal variety might be definitely settled.

I have therefore sent five full-grown specimens of this Bael, to be kept for the inspection of sceptics, and I enclose some of the leaves. In the parcel I have also forwarded some of the dried fruit, as used by me. This variety of Bael varies in size from a walnut, to that of a full-sized billiard ball. Of this size few are to be found. The fruit is tender to the middle of September after which the cortex begins to harden. The tree is from 12 to 16 feet in height. But the plant bears fruit, when four feet high, growing in a bush form; the fruit is always more or less pear-shaped. I think it will be admitted that the Madras authority was in error, and that the failure of local Bael powder and Bael fruit is due to the edible fruit being used in place of the medicinal one.

The time will come when the medical prejudice against the Bael fruit will pass away, and under these circumstances it is advisable that reliable information on the subject should be recorded for future use in the proceedings of the Society.

The Bael fruit of the "British Pharmacopœia" is the unripe dried fruit of the edible Bael or "Aegle Marmelos." This has been improved by cultivation and grafting, and the resulting "Kaugzee Bael," is the luscious, delicious fruit mentioned by O'Shaughnessy in the Indian Materia Medica. I mention this to remove the prevailing impression that the esculent green Bael, grafted or ungrafted, is medicinal when dried, but is non-medicinal when ripe. I never use the edible kind, and as the natural result my remedy does not fail. But in the Government Hospitals, bazar Bael is used, and I fear never succeeds. Thus the fruit is blamed

* Hurreepore is on the Old Simla Road, and is the second march from Kalkha to Simla Kussowlie being the first.

in place of the want of knowledge. I dare say there is not a shop in Calcutta in which the *Wild Medicinal Bael* is to be found. Yet the public place implicit confidence in the native Druggist, or "*Punsarree,*" and purchase his Bael chips for medicinal purposes.

The *Sherbet*, decoction, and spurious Bael Powder, made therefrom, does not answer expectation. The doctors very naturally oppose the use of Bael, and condemn it as absolutely valueless, and they are quite right for where *alvine fluxes* are concerned, the uncultivated (*i.e.*, not grafted) Aegle Marmelos of Bengal and Upper India is of no value for medicinal purposes. In like manner, the Bael of Bombay and Madras being an uncultivated edible Bael, is no better than that of Bengal. Cultivation and grafting will improve the fruit, but human knowledge is not sufficiently advanced to convert a *non-medicinal* fruit into a *medicinal* one by cultivation, nor will any amount of cultivation cause the medicinal Bael of the Himalayas to pass into a delicious edible fruit.

If the medicinal Bael is to be raised in Bengal, the proper place for growing it is "Parisnauth" Hill, and it would answer in the Hazareebaugh Hills. But being a hill sub-tree, its cultivation in the plains will not succeed."

The Secretary mentioned that he had submitted the above letter and specimens to Mr. John Scott, Curator of the Royal Botanic Gardens, who had favored him with the following remarks thereon :—

"With reference to yours of the 28th ultimo, enclosing for my perusal a letter by Lieutenant Pogson, on the so-called true medicinal Bael fruit, with specimens of the leaves and fruit for examination. The fruits forwarded seem to me to belong to the variety called by the natives Sreephul. Of this there is a wild and a cultivated form, and the former is that referred to by Lieutenant Pogson. The Sreephul is doubtless a variety of the Bael—Aegle Marmelos—differing only I believe in the fruits, the shell of which in the Bael—as recognised by the natives of Bengal—is smooth and rounded externally, whereas in the other it is flatter at the apex with a rough and more or less irregular surface. In the vicinity of Calcutta, the wild variety of the Sreephul seems to be very scarce, and I have indeed seen no living specimen of it, though I hear from some of the mallees in the gardens here, that it is found in the interior of Bengal, and that the fruits do not differ from those which I have shown them from Hurreepore Bael forest. I have no knowledge of the relative medical qualities of the wild varieties of Bael and Sreephul; but a decoction of the unripe and dried fruits of the former known as "*Bael Sooti,*" is, according to native practitioners, an excellent remedy for diarrhœa and dysentery. Dr. Stewart also in his "Punjab Plants" states that "the pulp of the fruit fresh or dried is undoubtedly of use in affections of the bowels; nor do I see any reason," he continues, "to place credit in a newspaper statement, that from the trees of these hills ('Kangra') it is less efficacious than from those growing further east."

Lieutenant Pogson certainly, as I think, errs in the asserting that no amount of cultivation will cause the medicinal Bael of the Himalayas to pass into a delicious

edible fruit. The Bael and Sreephul are undoubtedly varieties of one species, and we find the better kinds of both deteriorating alike when their culture is neglected; the fruits then decreasing in size, and becoming less palatable. I thus see no reason to doubt but that the wild Sreephul has given rise to the edible variety of our gardens. The better kinds of both varieties reproduce themselves truly by seeds, and they are thus rarely increased by layers or grafts. I send for comparison a few fruits of the wild variety of the Bael.

Lieutenant Pogson forwards, as he remarks, specimens of the leaves and fruit "in order that the question of the existence of the medicinal variety might be definitely settled;" thus assuming that recognised botanical differences indicate also the relative chemical or medical qualities, which of course they do not. The question at issue can only be settled by chemical analysis, or perhaps better by practical experiments, and thus showing their relative efficacy in the treatment of affections in the bowels. .... The remark that the variety referred to "being a Hill sub-tree, its cultivation in the plains will not succeed" is indeed, in the absence of direct experiments, a bold assertion. Within my own experience I could mention not a few Indian trees, many shrubs and herbaceous plants affecting much higher altitudes than that at which the so-called medicinal Bael is found, and which nevertheless thrive well in the plains. Indeed, as I previously stated, the mallees in the gardens here assure me that this variety is indigenous in the interior of Bengal. Dr. Stewart also states that 'this small tree which is not uncommon at different places below Simla to about 4,000 feet, extends sparingly up to near the Indus, and is said by Bellew and others to be found beyond that river: *it is occasionally seen* planted in the plains, the stems *attaining a girth of from two to three feet.*' The italics are mine."

Experimental Cultivation with Peas at Umritsur.

The Secretary next submitted a report from Mr. F. Halsey on the result of his experimental cultivation at Umritsur for raising Peas for the Society:—(*See Correspondence and Selections.*)

The best acknowledgments of the Meeting were given to Mr. Halsey for this very satisfactory report and for the trouble he has taken in raising this seed for distribution to the Members.

Destruction of Carolina Paddy by the Gandhee Fly.

The subject that next came before the Meeting had reference to the sample of Carolina Paddy already referred to as received from Mr. J. H. Bridgman of Newra, Goruckpore. Mr. Bridgman thus writes regarding it:—

"My time is now so short that I cannot go into much detail about the Carolina Rice. In 1868 a small quantity which I obtained in July from the Collector of Bustee was sown in my garden. Being sown so late it altogether escaped the fly, and being kept well-supplied with water it gave me, for the extent of land sown, an unusually large crop. The following year I sowed it more extensively,

I had seed enough for three or four small fields which I sowed at different times and in different ways. The whole throve very well, and looked remarkably fine; but, when the grain had formed and was still in the milky state, it was attacked by the gândhee or rice-fly, and so destroyed that I gathered little more than the seed I had sown. The country rice also suffered very much from the fly, though not quite so much as the Carolina. Last year I again sowed about as much as the year before. The country rice escaped the gândhee altogether, but the Carolina was more completely destroyed than the year before. Only a few seers have been sowed with which to try further experiments. We shall try sowing it on land favourably situated for unusually late sowing; but I confess I have little hope of a result sufficiently successful to make the cultivation of this kind of rice desirable. But for its liability to be attacked by this fly, its great productiveness and the strength of its stalk, which saves it from being laid by heavy rains and strong wind, would make it, in my opinion, preferable to any other kind of rice. The gândhee somewhat resembles in appearance a gigantic mosquito. Its colour is a greenish brown, and it has an offensive smell exactly like that of the little beetle commonly called the flying bug. It settles upon the rice when the grain is in the milky state, and, inserting a long probocis with which it is armed into the grain, sucks out the juice and leaves the husk quite dry. In the field from which I gathered the sample I showed you there were 6 to 10 flies on every ear throughout the field, and the whole crop was in a short time reduced to the condition of the sample. To study the habits of the insect, and, by doing so, discover some means of destroying the eggs or the larvæ before the crop is sown, would be the most likely way I fancy of getting rid of the pest."

The Secretary remarked that the ravages of this fly had been also brought to the notice of the Society by Mr. J. D. Gash of Pertabguh, Ourde, in a communication read before the Monthly Meeting of November last.

Medicinal Properties of the Dandelion.

Submitted the following remarks from Lieutenant Pogson, regarding the useful properties of the Dandelion of the Himalayas, of which he has sent seed for distribution :—

"On Tuesday last I despatched a small bangy parcel to your address, containing in addition to five specimens of the Medicinal Hill Bael, a good supply of the "Leontodon Taraxacum" of this range of the Himalayas, for distribution amongst the Members of the Agricultural and Horticultural Society.

There are two kinds of the plant here—one with large double flowers fully the size of a rupee in diameter and circumference; the other is a small single flower, rather larger than a six pence, and up to the size of an eight-anna bit.

I have sent the seed of the larger kind, as it possesses great medicinal properties, whilst the other does so in a slight degree only.

The seeds should be sown in beds, and the young plants, when of sufficient size, should be planted out on ridges, each plant being 9 inches distant from its neighbour. The tops of the ridges should be 9 inches apart.

The object to be attained is a large sized root, and for this purpose this form of planting is the best, because we can make certain of 9 inches of soft prepared soil in which the single root will flourish. To increase the size of the root the flowers, as they open, should be carefully gathered, and preserved by, being pounded down with ten per cent of their weight of sugar. This conserve is highly medicinal, and so is the fresh flower and flower stem.

The roots should be taken up after the rains, washed clean and wiped dry. They should then be pounded into a paste which should be put in suitable-sized tins or jars, and then be put in an oven after the bread has been withdrawn. They should be removed after one or two hours, according to the heat of the oven. On being cooled, the Taraxacum paste is ready for use, and with it all chemical preparations may be made.

If Taraxacum Coffee be desired the washed roots should be dried in the sun, then cut up into one inch pieces, and roasted exactly like ordinary (green) Coffee.

To prepare the Taraxacum Coffee (sold at an extravagant price by all Chemists of standing) proceed as follows :—

1st.—Roast a pound of the best Coffee procurable, as if for the preparation of that drink. Grind it as usual; and grind the roasted roots in the same manner, but by itself.

2nd.—To every nine ounces of Coffee, add one ounce of the Taraxacum Powder, and mix well together and run through a wire sieve.

3rd.—Put the "Taraxacum Coffee" so prepared in tins, and it is then ready for use and sale. The article is in great demand all over the civilized world, and will sell readily in the London and American market.

Medical men admit the value of this preparation, and I know several gentlemen in India who are, by their own admission, kept alive by the daily use of Taraxacum Coffee. It is fairly entitled to be called a specific for the cure of Torpid Liver, a complaint from which the majority of Europeans suffer. The fact being made known when they proceed to a cool or hill climate, and shiver and shake with cold, when the Thermometer is at 62° F. only.

The sallow complexion of such men, women, and children, their languid movements and their enjoyment of heat, all alike proclaim that they are suffering from sluggish action of the Liver.

The Conserve of Taraxacum may be made into Syrup for use. Horses, and valuable dogs, sheep, and poultry all suffer in India from disease of the Liver.

A bolus of Taraxacum conserve to a horse, and a pill thereof to a fowl would be most beneficial and act as a curative agent.

Rabbits also suffer greatly from Liver disease. But if they were supplied with a few (2 to 4) green Taraxacum leaves twice or thrice a week; the mortality resulting from this (hitherto) incurable disease, would disappear, and Rabbits could then be extensively reared for the market. I trust that after this explanation, the "Leontodon Taraxacum" will cease to be looked down upon as an useless weed requiring careful extirpation.

P.S.—At the low rate of one ounce of dry Taraxacum root per square yard containing 20 plants, we obtain 302½lbs. Av., and this at 2 Rs. per pound as the minimum, will yield an income of Rs. 604 per acre. The conserve at the lowest would yield 300 rupees, at a rupee per pound. Thus Tea and Coffee planters, and growers of Cinchona, might for the trouble of sowing and planting the Taraxacum, obtain a very considerable addition to their annual income.

Guinea Grass.

The Secretary mentioned that as a quantity of Guinea Grass seed had already been distributed from the large stock recently presented by Colonel Wintle, and as frequent applications were being received, he would beg to suggest the introduction into the Proceedings of this day's Meeting of directions for sowing and planting out this fine grass for general information. This was agreed to—

Prepare a bed, well manured and pulverised. Scatter the seed rather thickly on the surface and rake it in, or throw some soil over the seed just sufficient to cover it.

If the weather is dry and sultry, protect it by day with mats, letting it have the benefit of dew after sunset. If there be much moisture in the ground and air, such precaution is unnecessary.

Keep the young plants free from weeds, until they attain the height of 4 or 5 inches, when they are ready to transplant.

The field destined to receive the plants, ought to be dug with the *codalee* at least 18 inches, and the richer the soil and nearer water the better: then passed over with a common bamboo harrow, to break the clods, and smooth the surface.

Line off the ground 3 feet apart and plant out the grass in single stems, either close in a continuous line, or let each plant be one foot distant; the latter mode is preferable, being much easier to cut when the roots are detached.

The young plants should be watered every evening until they have taken root, (unless in the rains) when no further care is necessary, but weeding, which ought to be repeated until the grass has strength enough to keep the weeds down.

The grass should be cut when 3 feet high, unless the field is required for pasturing cattle, when it ought to be allowed to throw its seed, which, dropping between the ridges, will spring up and yield thick set roots throughout.

After the third cutting, the stubble should be set fire to, which will enrich the roots and cause them to shoot forth with renewed vigour.

Guinea Grass may be planted and reared *with care* at *any* season, but the best time for planting is the commencement of the rains, when no other labour than weeding is requisite.

The best season for cutting as a *hay* crop is just after the rains have taken off, but it must be cut when it is neither too old nor too succulent.

MISCELLANEOUS COMMUNICATIONS.

1.—From John Scott, Esq., presenting a paper for the Journal on the cultivation of Orchids.

In connection with the above the Secretary read the following extract of a letter from Dr. T. Beaumont, of Indore :—

"If I were able to attend your Meetings, I would name a vote of thanks to Mr. Scott for his very interesting notes on Horticulture in Bengal in the last part of your Journal. I hope they will not be his last."

The President said he fully endorsed Dr. Beaumont's remarks, and the vote of thanks were passed unanimously.

2.—From H. Rivett Carnac, Esq., Cotton Commissioner, forwarding printed extract of a letter from Major Trevor Clarke on the hybridization of Cotton.

Mr. Carnac adds—"The high position the writer occupies as an authority on all that relates to the improvement of Cotton generally, cannot fail to give an interest to these remarks, and I would beg to solicit your aid in working out in your gardens, any points in Major Trevor Clarke's letter that have hitherto been unsuccessfully tried in this country."

The Secretary remarked that the Society being, at present, unfortunately without a garden, were not in a position to meet Mr. Carnac's suggestion.

3.—From Lieutenant J. F. Pogson, acknowledging receipt of the "Climax" Potatos presented by Major Shelly. This "Potato" remarks Mr. Pogson, "is superior to any Potato, yet grown at Simla, and its introduction will be a public benefit. On receiving your letter under reply, I wrote up to Mr. Peterson, who takes great interest in agricultural and horticultural matters, and heard from him in answer that he will be happy to give his services in the matter."

4.—From the Officiating Secretary, Government of Bengal, Public Works Department, Irrigation Branch, returning thanks for 40 copies of Rice Statistics of Bengal, Behar and Orissa, in a tabulated form.

PLANTS EXHIBITED.

Rajah Suttyanund Ghosal exhibited flowering examples of *Dendrobium calceolys*, *Œrides rosea*, *Saccolabium guttatum*, *Crinum superbum* and herbaceous Phlox.

Mr. Scott forwarded from the Royal Botanic Garden a fine specimen in flower of *Vanda Lowei*, with the following note thereon :—

"I do not think flowering specimens of the *Vanda Lowei* have yet been exhibited at any of your Meetings, and as we have it in flower in the garden, I have

pleasure in sending a specimen. You will observe its peculiarity of producing flowers very different in colour; that at the base of the racemes of a deep dullish yellow with a very few small crimson spots: whereas the others 15 in number have a pale strawy yellow ground, clothed and spotted with pale crimson. The differently coloured flowers do not differ structurally; both are equally fertile when artificially fertilised, so that it is difficult to understand what purposes they may be subservient to in the economy of the plant. In several other kinds of orchids, variations in the colour and form of flowers is occasionally correlated with definite sexual characteristics, as in *Catasetum* and *Mormodes.* That the differently coloured flowers in *Vanda Lowei* have relation to the phenomena of fertilization, I suspect from the fact that the lower-most yellow coloured flower is strongly aromatic, and thus highly attractive to insects, while the others are but faintly odoriferous, and thus less attractive; and it may thus be that the solitary odoriferous flower may attract insects, and thus secure the fertilization of every flower in the raceme; the *Vanda Lowei*, like the majority of other orchids, being wholly dependent on insect agency for its proper fertilization."

The Secretary read the following extract of a letter received by the last mail from Mr. Grote:—

"I thought of Messrs. Jennings, Mowbray, Lynam and other exhibitors when I was at the last Kensington Flower Show. What would they have said to Lady Ashburton's glorious plant of *Phalænopsis Schilleriana*, with 230 blossoms on it? It was the grandest sight in the floral line that I ever saw."

Six marks were awarded to Mr. Roger's plant of *Wigandia Vogeri* exhibited at the last Meeting, it being quite a novelty, and said to have large and handsome foliage when fully developed.

For the above communications and contributions, the best thanks of the Society were accorded.

Thursday, the 15*th June* 1871.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:—Messrs. John Vernon, G. L. Kemp, John Beames, N. M. Gasper, C. W. H. Conroy, C. W. Oding, Frederick Peel; Sirdar Bhugwan Sing, the Deputy Commissioner, Boodannah District; Dr. David Picachy; Major W. A. D. Orchard; Captain W. S. A. Lockhart; Messrs. F. R. Deverell, John Radcliffe, T. U. Cargill, F. S. Collis, J. W. B. Skoulding; the Assistant Commissioner, Panchmari; Dr. S. C. Mackenzie, and Baboo Shamloll Dutt.

The names of the following gentlemen were submitted as candidates for election :—

Mohenderloll Khan, Narajole, Midnapore,—proposed by Mr. A. Rogers, seconded by Baboo P. C. Mittra.

J. Shaw, Esq., Sub-Deputy Opium Agent, Burhurwah,—proposed by Mr. T. M. Gibbon, seconded by the Secretary.

T. C. Lethbridge, Esq., Moorlah Factory, Chumparun,—proposed by Mr. Gibbon, seconded by the Secretary.

Colonel Hungerford Boddam, Deputy Commissioner, Hazareebaugh,—proposed by Colonel E. T. Dalton, seconded by the President.

G. M. Smith, Esq., Joyhinga Tea Estate, Lukimpore, Assam,—proposed by Mr. James Davidson, seconded by Mr. H. H. Sutherland.

Edwin Gilbert, Esq., Executive Engineer, C. I. Administration, Morar,—proposed by Major T. M. Shelly, seconded by the Secretary.

Captain J. Johnstone, Special Assistant to Superintendent of Tributary Mehals, Keonghur,—proposed by Mr. H. C. Marinden, seconded by Mr. C. J. Wilkinson.

Captain E. L. Hawkins, R.A., Morar,—proposed by Lt.-Colonel J. A. Wright, seconded by the Secretary.

Captain W. G. Maitland, Assistant Commissioner, Seebsaugor, Assam,—proposed by Mr. J. J. Guise seconded by Mr. T. H. Mosley.

Lieutenant L. J. H. Grey, Assistant Commissioner, S. W. Frontier,—proposed by the President, seconded by the Secretary.

Rejoined—R. P. Brooke, Esq., Bubnowly, Gorruckpore, and C. Wingrove, Esq., Tezpore, Assam.

The following contributions were announced :—

1.—Records of the Geological Survey of India, Vol. IV., Part 2,—from the Superintendent.

2.—Ditto ditto ditto ditto,—from the Govt. of Bengal.

3.—*Flora Sylvatica* for S. India, Part VIII,—from the Government of India.

4.—Report on the cultivation and preparation of Tobacco in India, by Dr. Forbes Watson, (2 copies),—from the Government of India.

5.—Report of the Bombay Chamber of Commerce for the year 1869-70,—from the Chamber.

6.—A complete collection of Vilmorin, Andrieux and Co's catalogues for 1869-70, —from Dr. Tonnerre.

7.—Four pamphlets connected with the annual exhibition of last year of the Royal Agricultural Society of England,—from Mr. S. H. Robinson.

8.—A quantity of acclimatized Cauliflower seed,—from Major J. Burne.

9.—A small collection of fruit grafts and of vegetable and flower seeds (acclimatized),—from Mr. T. M. Gibbon.

10.—A few tubers of rare kinds of Caladiums,—from Dr. T. Beaumont.

11.—A small assortment of acclimatized flower seed,—from Mr. W. H. Cheetham.

12.—A quantity of Teak seed,—from Mr. J. A. Crawford.

13.—Seed of *Stephanotis floribunda*,—from Mr. W. Halsey.

Mr. Halsey writes that one of his plants seeded last year in the month of May in great profusion, "in trying to ripen off all this seed it apparently so exhausted itself that it omitted its usual autumn flowering, and eventually many of the seed pods did not come to maturity. I tell you this to warn others not to attempt maturing more than two or three pods. For you lose the second flowering, and the seed pods take a whole year to ripen, having only just come off the plant."

The Secretary said he had given a portion of this seed to the Royal Botanic Garden, Mr. Scott having informed him that though the plant occasionally bears seed with them, it is always very sparingly.

14.—Cocoons of the *Antheræa Assama* and of the Bor Mooga Silk worms of Assam,—from Mr. J. M. Wood.

The Secretary mentioned that these had been obligingly sent to meet a requisition from Captain Hutton, to whom he had at once forwarded them.

15.—Pods of *Adansonia digitata* ("Boobab"),—from Mr. W. H. L. Renton.

Mr. Renton sends these from Banda, under the impression that they belong to the Tamarind family, by which name it is called there, and is used by the natives in the same manner as the pods of *Tamarindus Indica*. The tree is very rare in the district. The residents of Kallinger call it "Vilaytee Imlee."

16.—Specimens of certain gums from the Hazareebaug District, forwarded for report,—from Mr. Claud J. Dumaine.

17.—Specimen of an insect which did much damage to the mustard crop this year in the Futteeghur district, so much so that the price of mustard oil in the bazaar rose considerably; also specimen of a "Lady bird" which were unusually plentiful in the wheat this year; but had not, apparently, caused injury to the crop,—from Mr. E. Buck.

It was agreed to send these to Mr. Grote, and request some information regarding them.

Rice Husking and Winnowing Machines.

Messrs. T. E. Thomson and Co. submitted for inspection a full-sized rice husking and a winnowing machine, which had been made for them in Burmah. The cost of these two is Rs. 155, but Messrs. Thomson think they could sell them at a lesser figure if made here, as the charge of freight would be saved. They state they have found out some little defects in the construction which, however, need time to improve on, but which will admit of the husking machine being worked more efficiently. When these have been corrected, they will be in a position to state what will be the out-turn of the machine *per diem* when worked by one man.

In connection with the above the Secretary brought to notice a model of a Rice Mill, in the Society's Museum, on the same principle as that of Messrs. Thomson,

which was presented by Dr. Montgomerie in 1837, and of which full particulars are recorded at page 70 of the fifth volume of the *Transactions.*

REPORT ON GERMINATION OF IMPORTED SEEDS.

The first paper submitted was a tabular statement from Mr. John Scott, of the Royal Botanic Garden, showing the result of his trial sowings of the English and American vegetable seeds received in April last. Mr. Scott remarks :—"These results summarised show that of the 65 kinds supplied by Messrs. Barr and Sugden, the germination is 17 at 15 per cent, 18 at 41·7, 10 at 67·5, and 20 at 91. Those from D. Landreth and Sons, comprising 41 sorts, afford 5 at 13 per cent, 9 at 42·7, 11 at 65·10, and 16 at 93·12. The results are thus, I think, very satisfactory, and this the more especially so taking into consideration the late extreme humidity of the atmosphere; such conditions being much less favourable to the germination of seeds from temperate climates than the dry, though higher, temperature of the hot season."

The best acknowledgments of the Society were offered to Mr. Scott for his kind compliance with their request, as shown in the full and satisfactory statement now exhibited.

In connection with the above, the Secretary read the following letter from Dr. C. Prentis, Civil Surgeon, Gorruckpore, in respect to the germination of the field seeds imported last year from Melbourne :—

"If you have any available, could you kindly let me have some more Australian Field Seeds this year?

The result of my sowings of last season's supply, are as follows :—

1.—With the exception of the purple top Swede, the Turnips, especially the white globe and strap leaf, germinated freely, but nearly all, when only half-grown, were destroyed by an insect. Swedes do not appear to answer in this climate.

2.—The carrots came up very freely, grew rapidly, and in size and colour, sweetness and tenderness, were quite equal to those produced at home.

3.—The Mangold Wurzel succeeded admirably. It bore transplanting well, and seemed to be improved by it. The plants attained a good size, averaging in weight between 5 and 11 pounds, and many of them are still growing.

4.—The Tares grew most luxuriantly, but did not blossom.

5.—The Clover and other grasses germinated freely and answered well, especially the Lucerne, Prairie Grass, and Perennial Rye, but the Clover grew perhaps rather too slowly to be a paying crop.

Will there be any Australian vegetable seeds this year? Those sent last year germinated beautifully and are evidently suited to the climate."

Mr. Crosthwaite, C.S., writing from Budaon, also reports most favourably of carrots raised from Australian seeds. "The field carrots were very successful. The seed germinated well, and I got the finest carrots I have ever had. James Intermediate were particularly fine. The soil I grew them in was poor and had not been cultivated for some years."

DETAILS OF THE LAST ANNUAL SHOW OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

Read the following communication from Mr. S. H. Robinson, in reference to the pamphlets already entered under the head of Contributions :—

"I have sent you four pamphlets containing lists of the specimens exhibited and prizes awarded at the annual show of the Royal Agricultural Society of England which was held in July last at Oxford, and at which I attended. These may perhaps be of interest to some of our members who, like myself, have often regretted that nothing similar has been done to exhibit the agricultural produce of Bengal and take note of its improvement, since Sir Cecil Beadon's show at Belvidere in 1864.

"This Oxford Show was the first of the kind I had attended at home, and I was much struck with the extensive scale on which everything was brought forward. On reference to the pamphlets you will see that the total number of specimens and collections exhibited in the Agricultural Implement Department was 7,851. In this number were about 250 of manures and collections of agricultural seeds, the remainder comprehending every conceivable kind of agricultural machine and implements, all the stationary apparatus, such as corn-mills, thrashing-machines, chaff-cutters, dressing-machines, &c., being exhibited in motion and driven by some 150 portable steam engines: these latter were ranged along one side of a wide avenue, about half a mile in length, which served for the passage of the public, the machines being ranged behind the engines, and when all in motion forming of themselves an extraordinary spectacle. A large area besides was set apart for steam ploughs, reaping machines, and other moveable steam improvements.

"The Cattle Department attracted a large share of public attention, comprising 1,377 specimens and collections of the finest breeds in England, of horses, horned cattle, sheep, and, pigs, collected from all parts by 389 exhibitors. The amount awarded in prizes for these was £2,575, and for implements, &c., £369 ; but the money awards seemed to be only a secondary consideration with the exhibitors, their first object being the exhibition of their productions to the large assemblage of persons interested in their improvements with the view to sales and orders, and with whom no doubt a very large business was transacted. Of this some idea may be formed from the large number of admissions to the shows, which, in the 11 days it was open, amounted to 77,947.

"When our Society again possesses a piece of ground for their nursery garden, which, we may hope, will be before next cold season, I trust some attempt will again be made to exhibit Agricultural produce with our Horticultural shows. Since the last attempt was made, the extension of the Railways has opened facility for bringing in specimens for exhibition from more distant districts, and the Government having established a Department of Agriculture may be expected to aid such a project if initiated by our Society."

It was agreed to address the Government of Bengal in respect to the concluding portion of the above communication.

A FORAGE PLANT FOR DRY AND WET CULTIVATION.

Submitted the following paper from Major Boddam, on special duty, under the Mysore Government, in respect to the Northern Chinese Sugar-cane (*Sorghum saccharatum*) :—

"This remarkable plant is a native of the north of China. Its giant growth, and its beautiful and graceful appearance and refreshing greenness in the driest season, and the expectation of finding in it a rival to sugar-beet, induced the French Consul at Shanghai to send some sorgo seed to his Government. In 1854, Mr. Browne, Agent of the United States, Patent Office, took to America some French seed which was distributed by the Government. The plant was cultivated by a few farmers, but it received little attention until an ex-Governor of South Carolina reported the results of his trials to a farmer's club, which brought sorgo into notice. Since 1855 its cultivation has steadily increased, and it is now one of the great crops of the country. It is grown in France and Algeria for alcohol chiefly, and in America for seed, forage, sugar, syrup, alcohol, vinegar and beer. In the 10 North-Western States, where it flourishes, there were, in 1864, 366,670 acres of sorgo, and sorgo sugar was selling at Chicago at 4½*d.* per ℔. But for sugar, sorgo has turned out a failure. Its great merit as a forage plant is its principal recommendation; and on this point an official report of the United States Agricultural Department has declared that the *value of sorgo for feeding stock, cannot be surpassed by any other crop, as a greater amount of nutritious fodder can be obtained by it in a shorter time within a given space and more cheaply.* While grass yields a ton or a ton and a half of hay, sorgo will yield from 2 tons to 9 tons of dry fodder. Sorgo (*Lootsoh*) flourishes wherever Indian corn flourishes. The seed is sown for transplanting on warm ground, finely broken in the middle of April. The young plants are watered with liquid manure as soon as they appear, and in three or four days watering is repeated night and morning if the weather is dry. They are picked out, when 6 inches high, in rows 3 feet wide and 6 inches from plant to plant, and are again watered with liquid manure when a foot high. Weeds are kept down by hoeing until the cane matures, about November.

Chinese method of growing sorgo.

"The crop begins to come to market, however, early in September, or as soon as the stalks are sufficiently sweet for chewing. A Chinese labourer earning 10*d.* a day, can cultivate about 2 acres during the six months that the crop needs his labour.

"In America it is found that sorgo can be successfully grown on all lands where a fair crop of Indian corn can be grown. Deep loose warm soil, even of poor quality, produce thes weetest and most juicy stalks. Irrigation is recommended, but can seldom be attained in the United States. In deep black loam sorgo

reaches a height of 16 feet or 18 feet; what will it not do on our future sewage farms? The juice of the giant growth is not so sweet, nor is it easily crystalized. The seed should be soaked 24 hours in tepid water, in which 1 oz. of saltpetre is dissolved to every 6 gallons. It is then dusted with gypsum, and drilled 2 feet apart and 20 seeds per foot (for forage). In seven or eight days a horse sub-soil plough is put between the rows, up one side down the other. This cultivation is repeated as the crop advances, but the plants must not be earthed up. The upper roots spring from the stalk above the ground, and they must be left exposed. The first cutting may be made as soon as the crop is large enough for stock, and in ordinary seasons two others will follow. To dry the crop it should be set up in shocks, and the shock built with precautions for ventilation. One man, with a sub-soil plough, can cultivate 10 acres."

American Culture.

"Directions for growing Sorgo as Forage."

"Plough the land well and deeply, apply a liberal supply of stable manure, 6 to 7 tons per acre, if available; plough this in crosswise to the lines of the first ploughing, harrow and level, then sow the seed in drills, 26 inches apart, 20 seed per foot. In seven or eight days put a bullock hoe or cultivator between the rows up one side and down the other, or hoe the rows by hand. Continue this cultivation as the crop advances, but in no case earth up the plant stems, as they send out roots above grounds which must be left exposed. The first cutting will be made when the stalk is near 3 feet high. The plant will afterwards send out side shoots for a 2nd and 3rd cutting. To dry the crop it should be set up in shocks. and the shocks built with precautions for ventilation. As dry cultivation sow sorgo in the beginning of the monsoon, as wet cultivation in October. In an uncertain climate like Mysore, the benefit of deep ploughing will be apparent in seasons of scanty rain-fall. The roots of the plants will be able to go down deep for moisture and nourishment, instead of withering near the surface. Though plenty of manure is recommended, sorgo will do fairly without much manure. The more manure, the heavier the crop."

Proposed method for Mysore.

The Secretary remarked that the same mode of cultivation as is pursued on this side of India, for the "Sada-debdhan," would perhaps answer for the "Lootsoh," which, if not the same plant, is probably closely allied to it.

Applicability of Collodion for Garden purposes.

The Secretary next read extracts from letters from Mr. S. Jennings and Mr. John Scott on the above subject:—

Mr. Jennings.—"A suggestion appeared some short time ago in the *Pioneer* which is worthy of notice. Did you see the plan for securing cuttings from damp? It was to dip the ends in stiff collodion twice, and so covering it with a thin film impervious to damp. Nearly all cuttings perish from rot commencing just below

the soil, but if moisture can be kept off till the roots are strong, a great end will be attained, and this, I think, collodion will do."

Mr. Scott.—"Collodion has been used for many years in Britain as a preventitive for damp in the propagation of plants by cuttings, also as a remedy for bleeding, and as a ligature in budding. Mr. Lowe was the first to suggest its use, as being a substance possessing great adhesive powers, and also as being impermeable by air water. 'Believing'—remarks Lindley in his reference to the suggestion—, 'that the great difficulty attendant upon the multiplication of plants by cuttings arises from the tissues rotting by the excessive introduction of water, which the cuttings cannot decompose, or throw off as vapour,' it occurred to him that if the fresh end of a cutting were smeared with collodion, the injurious access of water would be cut off, and the risk much diminished. The results of his experiments confirmed his anticipations; out of 26 collodionised cuttings of stove plants 23 grew, while only 12 out of 26 grew, when the collodion was omitted. If, continues Lindley, instead of merely covering the cut end of the cutting with collodion, he had in some cases covered the cutting itself, as far as it was plunged in the soil, he would perhaps have had still greater success. There are two kinds of cuttings which are likely to demand this treatment—the one of succulent or very *soft* plants, which absorb abundantly through their skin; and the other of hard-wooded plants, of little substance, which become exhausted by the drying up of their organizable matter before roots can be formed.

"I may state that I am also trying the experiment of collodionising cuttings of such soft wooded plants as Pelargoniums, Coleus, Iresines, &c., with a view to their importation from Britain by sample post. I do not doubt that we may thus successfully introduce very many plants which are apt to rot when sent in the wooden cases: I am also having cuttings of some of the above named plants sent me from London by sample post, the cuttings being of partially ripened wood and each separately enveloped in gutta-percha or caoutchouc tissue, and placing all in a tin wooden box to prevent injury from pressure, &c.

Flowering specimen of Vanda Lowei.

In the letter above referred to, Mr. Jennings alludes to the account of the flowering plant of *Vanda Lowei* which was exhibited by Mr. Scott at the last Monthly Meeting. Mr. Jennings observes that it is by far the most difficult of all Orchids to carry, and will not bear a move even from Borneo, its native place, to Singapore. "The friend who sent it to me"—adds Mr. Jennings—"only saved a dozen out of 200 plants, and there are but very few plants in cultivation in England. I had it sent to me a number of times before the plant in question reached me, and that was first well established in a cocoanut before despatch; it was not packed at all, but hung up in the Captain's cabin. I gave it to the Botanic Garden, because I would not risk so delicate and valuable a plant up here (Allahabad)."

Mr. Scott writes :—" On submitting at the last Monthly Meeting of the Society the flowering specimen of *Vanda Lowei*, I ought to have stated that the gardens were indebted to Mr. S. Jennings for that very fine specimen. It was contributed in December 1869, and has now flowered for the first time."

A NEW FIBRE.

The Secretary called the attention of the Meeting, in reference to a notice in a recently received number of the Journal of the Society of Arts respecting a so-called "new fibre," from the bark of the Mulberry tree, to the fact that this same fibre had been submitted to the Society some 15 years ago by Signor Lotteri, and that a rather lengthy paper on the subject is to be found in the ninth volume of the Society's Journal, consisting of a translation from the "Annals of the Universal Society for the Encouragement of Arts and Industry" for September 1855, in which is a report by a special committee of that Society giving full particulars respecting this fibre and the various purposes to which it may be applied.

Letters were read—

From G. W. Shillingford, Esq., of Purneah, offering to raise vegetable and flower seeds for the Society, if a competent native gardener can be placed at his disposal for that purpose.

Resolved,—that Mr. Shillingford's kind offer be thankfully accepted if the services of such a man can be obtained.

From Colonel J. C. Haughton, returning thanks for the report on his tobacco samples.

From A. Grote, Esq., a long and interesting letter of which the following are extracts :—

" The phytophagous beetle which you sent me from Cachar and which I told you on Mr. Moore's authority was named *Physanchenia*, turns out, he tells me, to be *Dispromorpha melanopus*. I am putting specimens into Mr. Murray's hands for deposit in his interesting collection of insect in S. Kensington Museum. Mr. M. is the same who reared the leaf-insect some years ago in the conservatory at Edinburgh, and he was asking me to assist him in procuring him some more eggs of the insect. Perhaps you may be able to get some eggs from Cachar.

"Your brother, I see, sent you a *lusus naturæ* in the shape of maize growing in the place of flowers. All *lusus* of this kind are regarded with great interest here. If you have preserved this specimen and can spare it, please send it to me with any others that you do not want."

The Secretary mentioned he had sent the specimen by return mail, and had requested the aid of Mr. C. Brownlow for the eggs of the leaf-insect.

From S. Jennings, Esq., Allahabad, 5th June :—

" You will be sorry to hear of the fall of the great Tamarind tree in the Koosroo Bagh from sheer old age. It was one of the features of the garden, and its loss is a real calamity. It fell on the Queen's Birth Day, when not a breath of air was stirring. No amount of bracing or support could have saved it, and I am only glad

it happened, when no one was near. A short time ago a fancy-fair was held under its wide-spreading branches, and the beauty and fashion of Allahabad were assembled beneath it. Had it fallen then! but the mere idea is terrible."

For the above contributions and communications the best thanks of the Society were accorded.

Thursday, the 13th July 1871.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:—Mohenderlall Khan, Messrs. J. Shaw, T. C. Lethbridge, G. M. Smith, Edwin Gilbert, Captain J. Johnstone, Captain E. L. Hawkins, Captain W.G. Maitland, Colonel Hungerford Boddam, and Lieutenant L. J. H. Grey.

The names of the following gentlemen were submitted as candidates for election:—

W. H. Parker, Esq., Executive Engineer, Gwalior Division,—proposed by Major T. M. Shelly, seconded by the Secretary.

Secretary, Public Garden, Azimgurh,—proposed by the Secretary, seconded by the President.

Lieutenant-Colonel Charles Reay, Benares,—proposed by the Secretary, seconded by the President.

J. H. Fisher, Esq., c.s., Allahabad,—proposed by Mr. F. O. Mayne, seconded by the Secretary.

E. Dalbusset, Esq., Calcutta,—proposed by Dr. Tonnerre, seconded by the President.

Baboo Gungapershad, Deputy Collector, Moradabad,—proposed by Rajah S. A. Ghosal, seconded by Baboo P. C. Mittra.

W. A. Robinson, Esq., Umballa,—proposed by Colonel W. S. Row, seconded by the Secretary.

Secretary, Local Fund Committee, Belaspore,—proposed by the Secretary, seconded by the President.

Rejoined—R. J. Richardson, Esq., c.s., Ghazeepore.

The following contributions were announced:—

1.—Report on the cultivation, &c., of Tobacco in India, by Dr. Forbes Watson (2 copies),—from the Government of Bengal.

2.—Report of the Bengal Chamber of Commerce, from November 1870 to April 1871,—from the Chamber.

3.—On the introduction of the Citron tribe in N. S. Wales, by George Bennett,—from the Author.

4.—On the woods of N. S. Wales, by C. Moore, Esq., and on Silk, by Charles Brady,—from Dr. Bennett.

5.—The "Flora Sylvatica" of Southern India, Parts 9 and 10, by Major Beddome,—from the Government of India.

6.—Report of Department of Agriculture of Washington, for March and April 1871,—from the Consul-General, U.S.A.

7.—Application of Phytology to the industrial purposes of life, and the principal Timber trees, &c., of N. S. Wales, by Dr. Mueller,—from the Author.

8.—Journal of the Royal Horticultural Society of London, vol. 2, parts 7 and 8,—from the Society.

9.—A large quantity of Bamboo seed of two kinds,—from Dr. George King.

10.—Bamboo seed collected in the Jubbulpore district,—from Colonel C. S. Ryder.

11.—An assortment of acclimatized flower seeds,—from S. Jennings, Esq.

12.—A quantity of seed of *Dodonæa dioica*,—from F. Halsey, Esq. Mr. Halsey also sends a small quantity of the famous Bara rice from Peshawur. "I doubt this doing well in Bengal, but it is worth trying; it is the most highly-scented rice known, and in Runjeet Sing's time, was only grown for the Royal table."

13.—A good quantity of seed of *Acacia Sirissa* and of A. *diluta*, (?) gathered in the Dehra Doon,—from W. Minto, Esq.

14.—A small quantity of seeds of *Cassia* (pink) from Madagascar and of Cinnamon (Himalayas),—from Major T. M. Shelly.

15.—Seed of the medicinal gourd of the Hills,—from Lieutenant J. F. Pogson.

Flowering Plant of Vanda Batemanni, and Flowering Specimens of Arundina Bambusœfolia.

The Secretary called attention to the above plants which had been forwarded for exhibition by Mr. John Scott, Curator of the Royal Botanic Gardens, together with an interesting communication regarding them. The third plant (*Dendrobium Andersonii*,) not being in flower, Mr. Scott submitted a coloured drawing thereof.—(*See Correspondence and Selections.*)

Wild Medicinal Bael of the Himalaya.

The Secretary next submitted some further observations from Lieutenant J. F. Pogson, on the "Wild Medicinal Bael of Hurreepore" in continuation of those read at the Monthly Meeting in May last. He also submitted, in connection therewith, notes by Mr. John Scott, of the Royal Botanic Gardens, on the wild and cultivated Baels with reference to their medicinal properties.—(*See Correspondence and Selections.*)

The Sorgo, or Northern Chinese Sugar-cane, as a forage Plant.

Read a letter from the Secretary to the Government of India, Department of Agriculture, dated 23rd June, in reference to a memorandum from Colonel Boddam, which was inserted in the Proceedings of the last Meeting.

Submitted a reply from the Secretary, dated 8th July, to the above communication; as also Mr. Scott's memorandum.—*(See Correspondence and Selections.)*

TOBACCO CULTIVATION.

The subject that next came before the Meeting was a communication from the Cotton Commissioner for the Central Provinces and the Berars, forwarding an abstract of Dr. Forbes Watson's report upon tobacco. Mr. Rivett Carnac observes that this abstract has been drawn up by Mr. P. Robinson, who takes much interest in the improvement of tobacco cultivation in India, and who has also added some remarks of his own:—

Resolved—That the best thanks of the Society be given to Mr. Rivett Carnac for sending this abstract, and that as Dr. Watson's report may not be available to many interested in tobacco cultivation, it be introduced in the report of this day's Meeting.—*(See Correspondence and Selections.)*

STRAWBERRY CULTIVATION.

Read some remarks from Major T. M. Shelley on his mode of growing the Strawberry at the station of Morar.—*(See Correspondence and Selections).*

Letters were also read :—

1.—From Colonel Bacon, in charge of Home Department at Presidency, applying for all the information the Society can afford on the subject of Silk. Complied with.

2.—From H. Rivett Carnac, Esq., Cotton Commissioner, submitting copy of a report on Cotton cultivation in the Nicobars, and on sample of Cotton therefrom.

Mr. Rivett Carnac adds:—"The excellent quality of the Cotton produced cannot fail to make these experiments of importance, and I feel sure that any information regarding them will possess a full share of interest for your Society."

The Secretary remarked that a copy of this report was furnished by the Government of India, and acknowledged in the Proceedings for April last; and that a full report from the Society's Committee, on samples received direct from Col. Man, the Superintendent of Port Blair and the Nicobars, is published in the Proceedings for January last.

3.—From Major T. M. Shelley, presenting a paper for the Journal, entitled "Random notes about Gardens."

4.—From H. C. Erskine, Esq., of Elambazar, intimating that he has been obliged to abandon all further attempts at the cultivation of Carolina Paddy, as each successive season the "Gandheq" fly attacked the field of Carolina, leaving almost untouched the ordinary country paddy.

5.—From H. Rivett Carnac, Esq., advising despatch of seeds of two kinds of sacred Cotton from Central India to meet a requisition from Lieutenant Pogson. These were despatched immediately on receipt to Lieutenant Pogson.

6.—From James Fowler, Esq., Coffee-planter at Mercara, Coorg, Madras Presidency, applying for some of the *Taraxacum* seed presented by Lieutenant

Pogson at the May Meeting, as he is desirous of giving it a fair trial in his locality and of communicating the result. "Coorg enjoys an elevation of 2,000 to 4,500 feet above the sea level, gets four and five months of heavy rain, after which there are several months of dry weather, and possesses every variety of soil."

The Secretary observed that this application had received immediate attention. He had also had several other applications for this seed from various parts of the country.

7.—From Major Shelley, forwarding a programme of intended Horticultural exhibitions to be held at Morar in 1871-72. Major Shelley observes—"We have Colonel Hutchinson as President, Colonel Bird and self a committee. and a host of supporters, all members of the mother society in Calcutta."

8.—From Messrs. Law, Somner and Co., Melbourne, dated 20th May, intimating that the order for Field seeds is packed, and waiting for opportunity of despatch.

For the above communications and contributions the best thanks of the Society were accorded.

Thursday, the 17th August 1871.

J. A. Crawford, Esq., *President, in the Chair.*

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:—

Messrs. W. H. Parker, J. H. Fisher, c.s., E. Dalbusset, W. A. Robinson, the Secretary, Public Garden, Azimghur; Lieutenant-Colonel Charles Reay, Baboo Gungapershad, and Secretary, Local Fund Committee, Belaspore.

The names of the following gentlemen were submitted as candidates for election:—

Wm. Francis Graham, Esq., M.C.S., Ganjam,—proposed by Mr. F. J. V. Minchin, seconded by the Secretary.

Rajah Madho Rao, Bareilly,—proposed by Mr. C. M. Armstrong, seconded by Captain H. H. Birch.

J. R. Forbes, Esq., Extra Assistant Commissioner, Chota Nagpore,—proposed by Colonel E. T. Dalton, seconded by the Secretary.

Captain P. S. Marindin, R.E., Allahabad,—proposed by Mr. Julian Robinson, seconded by Mr. J. W. Sherer.

Wm. Harlow, Esq., Manager, Eastern Cachar Tea Co.,—proposed by Mr. Donald Steel, seconded by the Secretary.

Captain G. B. Worsley, Station Staff, Delhi,—proposed by Colonel J. S. Becher, seconded by the President.

Mrs. Annie Fox, Singhesur, Bhaugulpore,—proposed by the Secretary, seconded by Mr. R. Blechynden.

Huzrut Noor Khan, Minister of Jowra,—proposed by Dr. T. Beaumount, seconded by the Secretary.

Captain F. H. Woodgate, 14th Seik, Jullundur,—proposed by the Secretary, seconded by the President.

C. G. Master, Esq., M.C.S., Chatterpore, *vià* Ganjam,—proposed by Mr. F. J. V. Minchin, seconded by the Secretary.

The Commandant of the Erinpoorah Irregular Force,—proposed by the Secretary, seconded by the President.

Wm. DeCourcy Ireland, Esq., Deputy Commissioner, Akyab,—proposed by Mr. R. Redpath, seconded by the Secretary.

Dr. T. Ffrench Mullen, Residency Assistant Surgeon, Ulwar, Rajpootana,—proposed by the Secretary, seconded by the President

Major A. E. Campbell, Deputy Commissioner of Seebsaugor,—proposed by Captain W. G. Maitland, seconded by the Secretary.

Baboo Gopinath Roy, Calcutta,—proposed by Baboo P. C. Ghose, seconded by Dr. Tonnerre.

The Superintendent of the Patna Lunatic Asylum,—proposed by the Secretary, seconded by the President.

James Craven, Esq., Monghyr,—proposed by Mr. J. DaCosta, seconded by Mr. P. T. Onraet.

Captain A. C. Padday, Royal Engineers, Bareilly,—proposed by Mr. C. M. Armstrong, seconded by the Secretary.

Rejoined—T. B. Bennett, Esq., of Lallpore Factory, Purneah, and R. A. Sterndale, Esq., of Calcutta.

As a Honorary Member—Proposed by the Council, John Scott, Esq., Curator of the Royal Botanic Gardens, Calcutta.

The following contributions were announced :—

1.—Report on the Khooshroo Bag, Allahabad, for 1870-71, by S. Jennings,—from the Author.

2.—Reports on the cultivation of Cinchona at Darjeeling for the half-year ending 30th September 1870, and Annual Report on ditto for year ending 31st March 1871, and Report on the Botanic Gardens, Calcutta, from April 1870 to March 1871,—from the Officiating Superintendent.

3.—Journal of the Royal Agricultural Society of N. S. Wales, for May and June,—from the Society.

4.—Journal of the Asiatic Society of Bengal, Part I, No. 1, 1871,—from the Society.

5.—The *Flora Sylvatica* for Southern India, Part XI, by Major Beddome,—from the Government of India.

6.—Records of the Geological Survey of India, vol. 4, Part 3,—from the Superintendent.

7.—Sample of Cotton from Muneepore,—from General Nuthal, Officiating Political Agent.

8.—Samples of Cereals from Upper India, from W. H. Halsey, Esq., Secretary, Public Garden, Cawnpore.

9.—Cuttings of rare roses and bulbs of Gloxinias,—from Dr. T. Beaumont.

Mr. T. M. Francis forwarded for exhibition two seedling Roses with the following note:—

"I send herewith for inspection two seedlings of the Simla climbing rose, the seeds of which were sent by Lieutenant Pogson to the Society some time in February last. I obtained a packet of the seeds; and as all the Horticultural friends whom I consulted were unanimous in declaring that they could not possibly succeed in Calcutta, I sent the greater portion of them to a friend in England, retaining a few seeds to sow by way of an experiment. I sowed them in two shallow pans, one of which was filled with half-mould and sand in equal proportions, and the other with common garden soil. From these I raised seven plants, two in the common soil and five in the leaf-mould. Thanks to the unusually mild season which we have had, all the plants are doing well, and I hope that in a few months they will be thriving trees. Those which were sown in ordinary soil have thriven much better than the others, as you will see by the specimens which I send you, one of which is fully twice the height of the other. They have been kept almost entirely under shelter, as I was afraid that they might otherwise rot off from excess of moisture."

Cultivation of Cereals in Upper India.

The paper first submitted was an interesting communication from Mr. W. H. Halsey, Secretary of the Public Garden at Cawnpore, respecting certain kinds of Cereals raised in that garden and elsewhere, of which he sends specimens, and requests a report thereon.—*(See Correspondence and Selections.)*

Cotton from Munnipore.

Read a letter, dated 29th June, from Major-General W. F. Nuthall, Officiating Political Agent, Munnipore, regarding the sample of cotton already noticed.—*(See Correspondence and Selections.)*

Compton's Patent Chemical Manure.

The Secretary laid on the table several communications respecting this manure. The Government of India placed at the disposal of the Society at the close of 1869, a small quantity thereof which had been distributed to various applicants, but more especially to Managers of Tea Gardens in Assam and Cachar. The results have, in most instances, proved of a negative character. The only really satisfactory return is that of Mr. G. C. D. Betts, of Aurungabad Factory, (Moorshedabad District), as detailed in the following letter, dated November 1870:—

"I am in receipt of your favour of yesterday, and I have pleasure in reporting the results on the small quantity of "Compton's Patent Chemical Manure" you sent me up. I applied it as directed on 5 cottahs of land being a portion of 20 biggahs, which I sowed in paddy, and which I had manured

with animal manure. The former gave me a produce at the rate of 20 maunds the biggah (of 14,400 square feet), while the latter yielded about 12 maunds.

"My tenants, who had sown paddy all round my field, were (owing to the bad season) very unsuccessful with their crop. I don't believe that on an average they got more than 3 maunds the biggah. I should observe that my land was highly cultivated, well ploughed, and twice weeded; whereas my ryots only weeded their lands once. My opinion is that the chemical manure would answer very well for all crops in India, and that it would pay. I should have been glad to have used two tons of it with my winter crops of wheat, barley, and oats, if I could have got it."

TOBACCO CULTIVATION AT DHARWAR.

Read a letter from Mr. E. P. Robertson, Collector of Dharwar, in reference to the Tobacco Committee's report, submitted at the May Meeting, on his samples of tobacco.—*(See Correspondence and Selections.)*

TRANSMISSION FROM ENGLAND TO INDIA OF TIMBER TREES AND FLOWERING SHRUBS, HERMETICALLY SEALED, BY PATTERN POST.

The subject that next came before the Meeting had reference to a novel mode of transmission of living plants. In forwarding the extract relative thereto, the Secretary to the Government of India, in the Department of Agriculture, intimates that "the plan seems to the Governor-General in Council one that certainly deserves further trial and that might not improbably be generally adopted with advantage."

Extract, paragraph 14, *of a letter from the Superintendent of the Botanical Gardens, North-Western Provinces, to the Secretary to the Government of the North-Western Provinces,—No.* 393, *dated the* 20*th April* 1871.

Para. 14.—Timber trees and flowering shrubs. By Dr. Forbes Watson, three tin cases, filled with timber trees and flowering shrubs and hermetically sealed, were forwarded from the India Office per pattern post. Many of the plants were in excellent order and are now in a most thriving condition. This mode of transmitting plants is highly novel, and well worthy of being tried on an extensive scale with the finer kinds of flowering shrubs. But the cases ought to be forwarded from England in December, January, and not later, and the stems of the young plants ought not to be less than two-eighths of an inch in diameter. Leaden numbers ought to be attached to the plants to correspond with the numbers on the invoices. In the cases there were parchment labels, but most of them were destroyed by the moisture and heat.

The President read the following acknowledgment of the above communication:—

1. I have the honour to acknowledge receipt of your endorsement No. 2562, dated 12th instant.

2. I am desired to express the satisfaction of the Society that this first attempt of Dr. Forbes Watson in the transmission of timber trees and flowering

shrubs in hermetically sealed tin cases per pattern post has been attended with so much success.

3. Whilst recognising the great practical utility of Dr. Watson's novel mode of transporting trees, shrubs, &c., I am desired by the Society to point out that, however great may be the facilities offered to Government Officers, such as Dr. Watson, for sending such cases by pattern post, the public are precluded from adopting it as the Post Office authorities will not receive such packets or cases hermetically sealed or otherwise closely secured for transmission by pattern post. Until, therefore, some relaxation is made under this head, there is a practical restriction on the adoption of this means of transport.

4. The Society would, therefore, suggest the propriety of having this restriction relaxed, first in favor of public bodies like the Agricultural and Horticultural Societies of England, India, and the Colonies.

5. The Society would be glad to be furnished with a list of the trees and shrubs sent by Dr. Forbes Watson, noting those that perished, as also to be informed whether the trees and shrubs were rooted plants or cuttings, and how they were packed, whether with moss or mould round their roots, or the roots left simply bare.

6. If the process of hermetically sealing the cases had the effect of rotting parchment, the same excessive moisture and heat will destroy soft-wooded plants, as it does, in a short space of time, cuttings even after they have been hardened, however carefully packed.

FRUITING OF THE MALE PAPEEYA TREE.

Submitted the following letter from Mr. F. E. G. Matthews of Nynee-Tal on the above subject :—

"Perhaps it may interest you to know that a male tree of *Curica Papaya* has at Kaludoongee, at the foot of the hills, produced some three or four fruits. Instead of being produced, as in the case of the female tree on a short foot-stalk and close to trunk, they are developed at the extremities of the long branching stalks common to male trees when in flower. I examined a number of fallen flowers, but could perceive no change in their structure, apparently they possessed stamens only. I perceive that most works on Botany speak of the Papaya as plants bearing unisexual flowers, *i.e.*, staminal flowers and flowers with pistils on separate trees. The so-called female plant of Papaya appears to me to be a perfect flower, having both stamens and pistils, and the flowers do *not* grow in racemes as in the male plant. Whether the fruits on the male plant will ripen, or whether they will produce seed, I am not able to say. I will have them watched. But perhaps the phenomenon of fruit on male trees is familiar to you."

Remarks by Mr. John Scott.—"In the normal condition of the Papaw-tree the flowers are unisexual and dioecious (the male flowers being on one plant, the females on another) though not unfrequently we find male individuals in which many of the central flowers in every cluster are either *truly hermaphrodite* (with

stamens and pistil) or *female*, and then in all respects similar to those on the *female plant*. Now in the normal male flowers, the corolla is tubular, and bears ten slightly exserted perigynous stamens, five alternate with the petals and longer than those opposite to them. In the hermaphrodite flowers, the corolla has five distinct petals similar to those of normal female flowers, stamens five hypogynous (or inserted around the base of the ovary) and alternate with the petals, thus indicating strong systematic relations with plants, widely separated from it under the present classificatory arrangement. The fruit of these hermaphrodite flowers are usually about one-third less than those on female plants, in all other respects the same; the flowers are also perfectly self-fertile, as I have ascertained by artificial fertilisation with own-pollen. Amongst the seedlings thus raised there is further a great predominance of male plants, and nearly all bearing a considerable number of hermaphrodite flowers. In some of the seedlings of the second generation, there is also a very marked reduction in the length of the panicle; thus as I have stated above the panicles vary in length on the normal male plant, from 2, 4½ feet long; whereas in those bearing the hermaphrodite flowers I frequently find them only 6 or 12 inches in length.

. . . I shall follow up my experiments with those plants, fertilising individual flowers with own-pollen, and sowing the seed of these generation after generation, with the view of establishing a truly hermaphrodite race: such as, we may theoretically assume, an early progenitor of the Papaw has been. This seems to me supported by the fact, that though we do find occasionally hermaphrodite flowers on the female plants, we never do find normal male flowers; and thus as it appears to me does the occurrence of hermaphrodite flowers on the male panicles, (which with the super additions of stamens are identical with the normal female flowers) indicate the more lately acquired character of the structure of the male flowers; and their extreme modification as compared with those of an hermaphrodite structure, goes far to explain the more permanent character of the morphologically less modified female flowers."

PROPOSAL TO IMPORT ROOTS OF TRUE SARSAPARILLA.

Read a letter from Lieutenant J. F. Pogson, suggesting that the Society import roots of the true Sarsaparilla. The following is extract of the letter :—

"Would you be so good as to bring to the notice of the Council of the Agricultural and Horticultural Society—that in consequence of the very high price of true Sarsaparilla, an inferior substitute is used in the hospitals. The chemists charge six rupees for a pint of "Syrup of Sarsaparilla," which is as bad as 16 rupees for a ℔ of extract of Taraxacum.

"It is admitted that Sarsaparilla is a blood purifier, and as it is of great value, the Society would confer a boon on India if arrangements were made for obtaining either the seeds or suckers of the Red Jamaica Sarsaparilla, (*Smilax Sarsaparilla*,) for cultivation in this country.

"There is a shrub in the plains, which bears an edible fruit, the size of a pea, and deep puce colour. It is called Meekoe by the natives, and "Sarsaparilla" in Shakespear's Dictionary.

"The *Salsa* is also put down as Hindee for Sarsaparilla, of which the Arabic name is '*Ushba.*'

"In addition to these names, the hospital substitute is called '*Un-ununt-tomool,*' which may be another name for Sarsaparilla. But it is clear the genuine plant does not belong to India though I dare say it would answer very well.—If obtained from Jamaica, information as to soil and locality should be given, *i. e.*, whether it grows in the 'Blue mountains,' or in their valleys and plains. This is another plant, which our Tea and Coffee Planters should take in hand."

The Secretary mentioned that Mr. Scott had kindly responded to his request, in reference to Mr. Pogson's suggestion, by sending a memorandum on the medicinal Sarsaparillas, which he now begged to submit. While thanking Mr. Pogson for his communication, the Council were not, all circumstances considered, disposed to recommend the Society moving in the matter. The following is Mr. Scott's memorandum :—

"The *Smilax Sarsaparilla* was introduced to the Botanic Gardens here by Dr. Wallich in 1838, and in 1840 he says of it that 'although a native of the southern parts of the United States of America, the plant does not as yet grow very freely with us.' It struggled on, I believe, for a few more years under pot culture in the conservatory, and ultimately died. It was subsequently introduced by Dr. T. Anderson with the same results, so that there is evidently little hope for its successful culture in the plains of India. This is the less to be regretted, however, as notwithstanding the name of the plant, it does not yield any of the Sarsaparilla of commerce ; and there is no evidence that it ever did yield any. Dr. Wood remarks that its roots would certainly have been dug up and brought into the market, had it been found to possess the same properties with the imported medicine—*Periera.* While discarding this specimen, however, as the drug-yielder, I may state that there is yet considerable uncertainty as to the botanical origin of the several kinds of this drug met with in commerce. Periera states that *S. officinalis, H. Bk., S. Medica., Schlechtendal, and S. papyracea, Poiret*, are probably the species from which the greater part, if not all the Sarsaparilla, of commerce is obtained. The Red Jamaica Sarsaparilla, which is the best and most valuable kind in the market, is suspected by Pereira to be the produce of *S. officinalis.* It is a native of New Granada and chiefly found on the banks of the Magdalena near Bajorque. 'It is the Zarzaparilla of the natives of these regions by whom, according to Humboldt and Bonpland, large quantities are sent to Carthagena and Mompox ; whence it is shipped for Jamaica and Cadiz. It is largely exported from that Island to England, whence the name of Jamaica Sarsaparilla, for it was not then known to be indigenous in Jamaica. Simmonds, however, states that in 1853 'some thousands of pounds of Sarsaparilla were brought to Falmouth, Jamaica last year, and bought by merchants for export. It came from the province of St. Elizabeth, and there are whole forests covered with this *weed*, for such in reality it is. It is too the *real* black Jamaica Sarsaparilla that is much valued in the European and American markets. It is also found in other parts of the Island. *S. papyracea*

is found in the province of Rio Negro, in marshy forest tracts on the banks of the Japura near Porto dos Miranhos and various other moist forest regions in tropical America. Neither of the above species have as yet been introduced to our gardens here, though I do not doubt that they might be successfully cultivated in the moister of the tropical valleys of the Himalayas, though I do not think other culture in the plains of Bengal would be at all likely to prove a commercial uccess. The third species *S. medica* is found on the eastern slopes of the Mexican Andes, and according to Schiede is the only one of the numerous species found thereon which is collected in the villages of Papantla, Tuspan, Nantla, Misantla, &c., and carried to Vera Cruz, under the name of Zarzaparilla, whence it is sent into the European market as *Vera Cruz Sarsa.* This species naturally affecting moist and shady, though well drained localities (somewhat similar to those of that other valuable drug-yielding root Ipecacuanha) might doubtless also be afforded suitable sites on the moister of the forest clad flanks of the tropical Himalayas. The roots of the different species might be easily imported in quantity by mail steamers in closed boxes from Jamaica to England, thence to India *viâ* the Suez Canal. Thus sent, the roots should arrive in good order if taken up while dormant (or at least when vitality is lowest, for I believe the above named species are ever-greens in their indigenous *habitats*), exposed in an airy verandah until free of any extraneous moisture, and then placed in layers alternating with others of a stiff and dry soil.

"Roxburgh has the following remarks on the medicinal virtues of the two following Indian species :—*Smilax glabra* is a native of Sylhet and of the adjacent Garrow country where it is called Harina or Hurina-shook-China. Its root is large and tuberous, and not to be distinguished by the eye from the medicinal drug brought from China under the name of China root. The natives of the above countries prepare a decoction of the fresh root annually for the cure of sores and venereal complaints. *S. lancæfolia* is called Gootea-shook-China by the natives of Eastern Bengal where the plant is indigenous, and its large tuberous roots are much used by them in medicine. They are so like those of *Smilax China* as not to be distinguishable by the eye. By the natives the juice of the fresh root is taken inwardly for the cure of rheumatic pains, and the refuse, after extracting the juice, laid over the most affected parts. Both species. I hear, have been introduced from time to time into the Botanic Gardens here, though with no great success, and they seem to have been lost many years ago. The roots of the *Smilax ovalifolia*, the Koomurki of the Bengalees, have also had medicinal qualities ascribed them, but this is apparently a mistake as I cannot hear of their being thus used in India as stated in the Treasury of Botany.

"*Smilax China* is as its specific name implies a native of China, and a somewhat prickly undershrub of from two to three feet in height, though attaining a greater size and a scrambling habit when growing in thickets. The rhizoma of this forms one of the *China roots* of the shops; it is recommended as a substitute for Sarsaparilla. The Chinese eat it under the idea that it invigorates them.—*Lindley.* Baboo K. L. Dey, of the Calcutta Medical College, remarks in

his 'Indigenous Drugs of India,' that the root is largely used by native physicians, under the name of *Chob Chinee.* It resembles Sarsaparilla in its medicinal properties, and can be given with advantage for the same purposes for which the other (called here *Sálsa* or *Shorib*) is prescribed. The market rates are about one rupee four annas per lb. I cannot hear that this species has as yet been tried in the Botanic Gardens here.

"I find from some of the old garden records that Dr. Wallich cultivated somewhat extensively in the Botanic Gardens here the Indian Sarsa—*Hemidesmus indicus*—the *Ununtomool* of the Hindoos. He thus writes of it:—'This country fortunately affords an excellent equivalent for Sarsa in the *Ununtomool*, which, besides possessing while fresh a very grateful smell, has all the virtues of the genuine drug, and may be procured, with a little exertion at a far lower rate than the imported precarious and expensive American Sarsa; that is, at about *four annas* per seer. By desire of the Medical Board I have furnished the dispensary with 13½ maunds of the recent root at the above rate since April last, and I hope soon to supply a further quantity. The shrub is of a nature that requires much space and shade to yield a plentiful return of root; I have notwithstanding taken steps to cultivate it so as in time to furnish a large quantity without any extra cost.' On the medicinal qualities of this plant, Pereira remarks, that it has been employed as a cheap and efficacious substitute for Sarsaparilla in cachetic diseases; but both its effects and uses require a more extended examination than has yet been devoted to them. Dr. Ashburner says that it increases the appetite, acts as a diuretic, and improves the general health, 'plumpness, clearness, and strength, succeeding to emaciation, muddiness, and debility.' It has been used with benefit in venereal diseases. In some cases it has appeared to succeed where the Sarsaparilla had failed and *vice versa*, it has frequently failed where Sarsaparilla succeeds.—*Materia Medica.* Dr. O'Shaughnessy considered the activity of this medicine to be much more decided than that of Sarsaparilla. In the Calcutta bazaar the dried roots are sold at about 12 annas per seer, and this though exactly treble that at which Wallich supplied them to the dispensary would not as a cultural product realise the ground-rent to the culturist.

"I don't know what plant may be referred to by Mr. Pogson as producing the edible fruit, &c., and called *Mukoe* by the natives."

Letters were read :—

From the Secretary, Government of Bengal, and the Superintendent of Studs, N.W.P., applying for information in connection with Colonel Boddam's memorandum regarding the 'Sorgo' plant.

The Secretary mentioned he had, in reply, referred to the communications the Society had sent to the Government of Bengal as introduced in the Proceedings of the last (July) Meeting.

From Colonel Horace Brown, Deputy Commissioner, Thayetmyo, British Burmah, asking for a silk-reeling apparatus, and promising to send silk worms eggs.

From H. Leeds, Esq., Conservator of Forests, Bengal, applying for information regarding the silk yielders of Assam and mode of cultivation, &c. (Complied with.)

On the propagation and culture of Ornamental Shrubs, Climbers, Creepers and Perennial Plants by means of cuttings.

In consequence of numerous and annually increasing applications from non-resident Members for ornamental plants, and the heavy expense and risk attending the conveyance, for any distance, of rooted plants by line of rail, bullock train and other conveyance, it has been deemed desirable to compile the following list of such ornamental shrubs, plants and creepers as are susceptible of being propagated by cuttings; in order that, by the less inexpensive mode of transit (*viz.*, pattern post), Members in all parts of India may readily avail of such cuttings, and thus at a trifling expense to themselves, carry out one of the primary objects of the Society, *viz.*, the extending of such culture throughout the country.

Moreover, the propagation of plants by such process cannot fail to be otherwise than most interesting to every botanist, professional and amateur; and as an encouragement to all, the following is extracted from a letter received from a zealous Member of the Society, resident at Indore, to whom a packet of 50 cuttings were sent per pattern post at a cost of two rupees inclusive of postage:—

"I should have written sooner to thank you for the very "extensive collection of cuttings you were so kind as to send "me, but I waited that I might be able to tell you how they "were likely to do. They arrived in very good condition, "having been packed most carefully, and on opening the "package, I found several had already begun to form a "callus. Indeed, I hope that all of the varieties that take "with moderate readiness from cuttings will do."

Selected List of cuttings generally available at the Nursery Department, Agri-Horticultural Society of India, Calcutta.

CLIMBING PLANTS.

No. 1. Allamanda Aublettii.*
„ 2. ——— cathartica.*
„ 3. ——— Schottii.*
„ 4. Antigonon leptopus. (Sandwich Island Climber).*
„ 5. Argyreia speciosa.*
„ 6. Aristolochia labiosa.†
„ 7. Bignonia Chamberlaynii.*
„ 8. ——— gracilis.*
„ 9. ——— picta.*
„ 10. ——— venusta.†
„ 11. Bougainvillea glabra.†
„ 12. ——— spectabilis.†
„ 13. Centrosemma Plumieri.*
„ 14. Chondrospermum dentatum.*
„ 15. Cissus discolor.*
„ 16. ——— quadrangularis.
„ 17. Clerodendron Thomsonæ.
„ 18. Clitorea ternatea, fl: pleno.
„ 19. ——— alba.
„ 20. Combretum comosum.†
„ 21. ——— grandiflorum.†
„ 22. Cryptostegia grandiflora.*
„ 23. Cuscuta reflexa.
„ 24. Ficus repens.*
„ 25. —— stipulata.*
„ 26. Holmskioldia sanguinea.
„ 27. Hoya bella.*
„ 28. —— carnosa.*
„ 29. —— species.*
„ 30. Ipomœa Learii.

„ 31. Ipomœa semperflorens.
„ 32. Lonicera brachypoda.*
„ 33. Lophospermum scandens.*
„ 34. Macfadyena uncinata.
„ 35. Manettia cordifolia.*
„ 36. Maurandya Barclayana.*
„ 37. Murucuja ocellata.*
„ 38. Passiflora cœruleo-racemosa.
„ 39. ——— edulis.
„ 40. ——— Goutierü.
„ 41. ——— holosericea.
„ 42. ——— Kermesina.
„ 43. ——— laurifolia.
„ 44. ——— Middletoniana.
„ 45. ——— quadrangularis.
„ 46. Pereskia aculeata.
„ 47. Pergullaria odoratissima.
„ 48. Rhyncospermum jasminoides.†
„ 49. Roupellia grata.
„ 50. Tecoma capensis.
„ 51. ——— jasminoides.
„ 52. Thunbergia grandiflora.
„ 53. ——— laurifolia.
„ 54. ——— Hawtaynü.
„ 55. Vanilla planifolia.
„ 56. Wisteria sinensis.†

PERENNIAL PLANTS.

No. 57. Ærua sanguelenta.‡
„ 58. Aloysia citriodora.
„ 59. Angelonia grandiflora.
„ 60. Aphelandra fulgens.
„ 61. Arthrostemma lineata.
„ 62. Asystasia chelonoides.
„ 63. ——— Coromandeliana.

„ 64. Barleria cœrulea.
„ 65. ——— ciliata.
„ 66. ——— cristata.
„ 67. ——— Gibsoni.
„ 68. ——— lupulina.
„ 69. ——— Prionitis.
„ 70. ——— rosea.
„ 71. Begonia argyrostigma‡
„ 72. ——— hydrocotylifolia.
„ 73. ——— reniformis.
„ 74. Böhmeria nivea (Rheea).
„ 75. Cacalia carnosa.
„ 76. Centradenia floribunda.*
„ 77. Coleus Blumei‡
„ 78. —— scutellairoides.‡
„ 79. —— Verschaffettü.‡
„ 80. —— 12 new hybrids.‡
„ 81. Crossandra infundibuliformis.
„ 82. ——————— variety.
„ 83. Dœdalacanthus nervosus.
„ 84. ————— strictus.
„ 85. Eranthemum Blumei.
„ 86. ———— crenulatum.
„ 87. ———— grandiflorum.
„ 88. ———— pulchellum.
„ 89. Goldfussia ainsophylla.
„ 90. ——— isophylla.
„ 91. Heliotropium Peruvianum.‡
„ 92. Iresine Herbstü.‡
„ 93. ———— aureo-reticulata.‡
„ 94. Justicia carnea.
„ 95. ——— Gendarussa.
96. Linum tetragynum.
97. ——— trygynum.

„ 98. Lantana Sellowiana.
„ 99. Lotus Jacobeus.*
„ 100. ——————— luteus.*
„ 101. Pentas carnea.
„ 102. Petalidium bignonaceum.
„ 103. Plumbago rosea.
„ 104. ————— capensis.
„ 105. ————— Zeylanica.
„ 106. Ruellia prostrata.
„ 107. Russelia floribunda.
„ 108. ————— juncea.
„ 109. Salvia coccinea.
„ 110. ——— splendens.
„ 111. Sericographis squarrosa.
„ 112. Stachytarpha Jamaicensis.
„ 113. ——————— unitabilis.
„ 114. Stemonocanthus formosus.
„ 115. Strobilanthus Sabinianus.
„ 116. ——————— tomentosa.
„ 117. Turnera trioniflora.
„ 118. Verbena venosa.
„ 119. ————— hybrida.
„ 120. Vinca rosea.
„ 121. ——————— albiflora.
„ 122. Viola odorata.

SHRUBS.

„ 123. Acalypha tricolor.* ‡
„ 124. Allamanda nerüfolia.*
„ 125. Brugmansia suaveolens.*
„ 126. Buddlea Lindleyana.
„ 127. Cassia auriculata.*
„ 128. Catesbœa spinosa.†
„ 129. Clerodendron of sorts.

„ 130. Codiœum (Croton) latifolium.‡
„ 131. ——— longifolium.‡
„ 132. ——— pictum.†
„ 133. ——— variegatum.‡
„ 134. Crescentia Cujete.
„ 135. Dracœna Australis.‡
„ 136. ——— Jacquini.‡
„ 137. ——— terminalis.
„ 138. Duranta Ellisii.
„ 139. ——— Plumieri.
„ 140. Erythrina Blakei.*
„ 141. Forsythia viridissima.
„ 142. Franciscea latifolia.†
„ 143. Gardenia florida.
„ 144. ——— Fortuneana.
„ 145. Ginoria Americana.
„ 146. Hamelia patens.
„ 147. ——— sphœrocarpa.
„ 148. Hibiscus mutabilis.
„ 149. ——— Cooperii.‡
„ 150. ——— rosa sinensis.
„ 151. ——————— varieties
„ 152. ——— Syriacus.
„ 153. Hypericum Chinense.
„ 154. Ixora bandhuca.
„ 155. —— coccinea.*
„ 156. —— incarnata.*
„ 157. —— ragoosula.*
„ 158. —— rosea.*
„ 159. —— stricta.*
„ 160. Jacquinia ruscifolia.
„ 161. Jasminum laurifolium.
„ 162. ——— sambac.
„ 163. ———————, fl : pleno.

„ 164. Lawsonia alba.
„ 165. Lemonea spectabilis.†
„ 166. Malpighia coccifera.
„ 167. ——— glabra.
„ 168. ——— urens.
„ 169. Meyenia erecta.
„ 170. ——— alba.
„ 171. Morus Indica and varieties.
„ 172. Murraya exotica.
„ 173. Mussœnda frondosa.*
„ 174. Myrtus communis.*
„ 175. Nerium odorum.*
„ 176. Olea fragrans.†
„ 177. Panax cochleata.
„ 178. ——— fruticosa.
„ 179. Psychotria undata.
„ 180. Punica granatum, fl: pleno.
„ 181. ——— nana.
„ 182. Roses in variety.*
„ 183. Ruta angustifolia.
„ 184. Salix Babylonica.
„ 185. Serissa fœtida.
„ 186. Spirœa corymbosa.
„ 187. Tabernœmontana coronaria.

* *This mark represents plants that require some care to get them to strike.*

† *This mark represents plants that will only strike in sand beds under glass.*

‡ *This mark represents plants of handsome foliage.*

Those not marked are easily propagated.

N. B.—A copy of this list is retained in the "Nursery Department" of the Society. Members desirous of obtaining cuttings of any particular kind or variety, instead of a

general assortment, need only quote in their requisition, the number affixed to the particular kind required; and in the execution of every requisition, the numbers corresponding with the general list will be attached to the cuttings.

Non-resident Members are requested to accompany their requisitions with remittances to meet the cost and charges of transmission. The observance of this rule will ensure to such Members prompt attention and comparatively trifling expense, as "prepaid" packages are conveyed at half the expense they would otherwise cost.

On the propagation and culture of ornamental Shrubs, Climbers, Creepers, Perennial plants, and Fruit trees, by means of layers, division of roots, budding, ball graft, &c., during the rainy season.

The preparation of the following papers has been suggested, as a companion to the paper on the propagation of shrubs, &c., by means of cuttings, (Journal Part 1, Vol. 2, new series,) and will prove useful in extending the culture of such kinds given in the lists, which either do not seed, or cannot be depended on if raised from seed.

Selected list of Shrubs and Trees capable of propagation by layers, division of roots, and gooties, (ball graft), during the rainy season.

Allamanda neriifolia	...	By layers.
Amherstia nobilis	...	„ layers.
Astrapœa Wallichii	...	„ layers.
Bambusa, of sorts	...	„ division.
Brunfelsia, of sorts	...	„ layers.
Catesbœa spinosa	...	„ layers.
Cerbera fruticosa	...	„ layers.
Crescentia cujete	...	„ layers.
Cryptomeria Japonica	...	„ layers.
Cupressus, of sorts	...	„ layers.
Dombeya, of sorts	...	„ layers.
Erythrina, of sorts	...	„ gooties and layers.
Filicium decipiens	...	„ layers.
Franciscea, of sorts	...	„ layers.
Gardenia lucida	...	„ layers.
Ginora Americana	...	„ layers.
Ilex Paraguayensis	...	„ layers.
Ixora, of sorts	...	„ layers.
Jacquinia ruscifolia	...	„ layers.

Propagation & culture of ornamental Shrubs,

Jasminum, of sorts	...	By layers.
Juniperus, of sorts	...	„ layers.
Lagerstromia Indica	...	„ layers.
Lemonia spectabilis	...	„ layers.
Magnolia, of sorts	...	„ layers and gooties.
Murraya exotica	...	„ layers.
Mussænda frondosa	...	„ layers.
Myrtus communis	...	„ layers.
Nerium odorum	...	„ layers.
Olea fragrans	....	„ layers.
Olea myrtifolia	...	„ layers.
Rondeletia punicea	...	„ layers.
Swietenia mahagoni, (mahogany)		„ layers.
Talauma pumila	...	„ layers.

Selected list of flowering Plants easily propagated by layering, grafts, and division of roots, during the rainy season.

Aloysia citriodora	...	By layers.
Anemone Japonica	...	„ division.
Bæhmeria nivea	...	„ division.
Chrysanthemum, of sorts	...	„ division.
Crinum, of sorts	...	„ division.
Dahlia, of sorts	...	„ division.
Euphorbia jacquiniflora	...	„ layers.
Gesneria, of sorts	...	„ division.
Gloxinia, of sorts	...	„ division.
Hydrangea, of sorts	...	„ division.
Russelia, of sorts	...	„ division and layers.
Solidago canadensis	...	„ division.
Verbena hybrida	...	„ division.
Viola odorata, sweet violet	...	„ division.
Bulbs	...	„ division.
Ferns	...	„ division.
Roses	...	„ budding, grafting, and layering.

Selected list of creeping and climbing Plants capable of being propagated by grafting, division of roots, layering, budding, &c.

Allamanda, of sorts	.	By layers.
Akebia quinata	..	„ division of roots.
Argyreia, of sorts	.	„ layers.
Aristolochia, of sorts		„ layers.
Asparagus racemosus	.	„ division of roots.
Bannisteria laurifolia	.	„ layers.
Beaumontia grandiflora	.	„ layers.
Bignonia, of sorts	.	„ layers.
Bougainvillea, of sorts	..	„ layers.
Cœsalpinia Grahami	.	„ layers.
Ceropegia Garderi	..	„ layers.
Chrondrospermum dentatum	..	„ layers.
Combretum, of sorts	..	„ layers.
Congea tomentosa	..	„ layers.
Cryptostegia grandiflora	..	„ layers.
Dalechampia Madagascarensis		„ layers.
Echites, of sorts	..	„ layers.
Frederickia Guilelmi	...	„ layering or grafting on Bignonia stock.
Gloriosa superba	..	„ division of roots.
Hiptage madablota	..	„ layers.
Jasminum, of sorts	..	„ layers.
Lonicera, of sorts	..	„ layers.
Macfadyena (Bignonia) uncinata		„ division of roots.
Manettia cordifolia	...	„ layers.
Parsonsia corymbosa	..	„ layers.
Passiflora, of sorts	..	„ layers.
Petræa volubilis	..	„ layers.
Plumbago capensis	..	„ layers.
Poivrea coccinea	..	„ layers.
Poivrea grandiflora	..	„ layers.

Rhyncospermum jasminoides ...	By	layers.
Roupellia grata ...	„	layers.
Stephanotis grandiflora ...	„	layers.
Stigmaphyllon periplocifolium	„	layers.
Tecoma, of sorts ...	„	layers.
Thunbergia, of sorts ...	„	layers.
Unona lævigata ...	„	layers.
Wisteria sinensis ...	„	layers.

Selected list of Fruit Trees capable of propagation by layering, grafting, and budding.

Apples, (Pyrus malus) ...	By	layers.
Avocadopear, (Persea gratissima)	„	layers and seeds.
Bâer, (Zizyphus jujuba) ...	„	budding on common baer stock.
Bael, (Ægle marmelos) ...	„	grafting on common bael seedlings.
Banana, (Musa sapientum) ...	„	division of roots.
Bullock's heart, (Anona reticulata)	„	layers.
Cherimoyer, (Anona cherimola)	„	layers.
Citron, (Citrus media) ...	„	grafting on seedling citron and gooties.
Custard-apple, (Anona squamosa)	„	layers.
Fig, (Ficus carica) ...	„	layers.
Granadilla, (Passiflora edulis) ...	„	layers.
Guava, (Psidium) ...	„	layers.
Jamrool, (Jambosa alba) ...	„	layers.
Kuronda, (Carissa carandas) ...	„	layers.
Lemon, (Citrus limonium) ...	„	grafting and budding on lime seedlings and gooties.
Litchee, (Nephelium lichi) ...	„	gooties.
Lime, (Citrus acida) ...	„	grafting and budding on lime seedlings and by gooties.

Long plum, (Zizyphus vulgaris)	By	budding on Zizyphus seedlings.
Loquat, (Eriobotrya Japonica)	„	gooties.
Mango, (Mangifera Indica) ...	„	grafting on mango seedlings and by gooties.
Olive, (Olea)	„	layers.
Orange, (Citrus Aurantium) ...	„	gooties and grafting on orange seedlings.
Peach, (Amygdalus Persica) ...	„	grafting and budding on peach seedlings.
Pear Dessert, (Pyrus communis)	„	grafting and budding on pear seedlings and by layering.
Pine-apple, (Ananassa sativa)	„	division of roots.
Pomegranate, (Punica granatum)	„	layers.
Pummelo, (Citrus decummana)	„	budding and grafting on seedling pummelo and gooties.
Rose Apple, (Jambosa vulgaris)	„	layers..
Sapota, (Achras sapota)	„	grafting on sapota seedlings and by layering.
Strawberry, (Fragaria vesca)	„	division of roots.

Agricultural and Horticultural Society of India.

FOUNDED A. D. 1820.

OBJECTS AND UTILITY.—Development of the Agricultural and Horticultural resources of India, its encouragement, promotion, extension and improvement, in all its varied branches of usefulness, under the management of a Council appointed at Annual Meetings of Members, held in January of each year. An extensive and valuable Library of reference and a Museum are attached to the Society.

MEETINGS—Are held once a month—open to all Members.

ORDINARY MEMBERS.—Ladies and all sects and classes of the European and Native community of India are eligible for election as Members.

TERMS OF ADMISSION.—Entrance Fee, Rupees 8; Annual Subscription, Rs. 32, payable quarterly in advance, or Members may compound for the quarterly Subscription by the payment of Rupees 320.

MEMBERSHIP ADVANTAGES.—Annual free distribution of imported garden vegetable and flower seeds from the first seeds-men in England, America and France; acclimatized seeds and field seeds from Melbourne. Journals of the Society are also issued from time to time to Members as published. Ornamental plants grown specially for Members from the best available stock and grafts of choice fruit-trees, which last only is required to be paid for at certain fixed cost price.

EQUALIZATION OF PRIVILEGES.—Newly elected Members, and Members rejoining the Society at any advanced period of the year, but electing to pay the full year's Subscription, will

be classed with old Members and participate in full privileges, or they will be subject to certain reduction of privileges as provided for in the rules.*

Annual Shows.—Horti-Floricultural, to which Members have free admission.

Metcalfe Hall; } A. H. BLECHYNDEN,

Calcutta, the 16*th March* 1870. } *Secretary.*

* *Vide* Part IV., Vol. I., New Series, for Code of Bye-Laws.

Kumrunga	Averrhoa Carambola	„ „	„ 1 0 0
Lemon	Citrus Limonum	„ 1 0 0	„ 0 4 0
Litchee	Nephelium Lichi	„ 1 0 0	„ 0 8 0
Lime	Citrus acida	„ 1 0 0	„ 0 4 0
Loquat	Eriobotrya Japonica	„ 1 0 0	„ 0 8 0
Mangoes	Mangifera Indica	„ 1 0 0	„ 0 4 0
Mulberry	Morus	„ „	„ 0 4 0
Otaheite Apple	Spondias dulcis	„ 1 0 0	„ 0 8 0
Orange Silhet	Citrus aurantium	„ 1 8 0	„ 0 8 0
Palm Fruit or Tal gachh	Borassus flabelliformis	„ „	„ 0 12 0
Puncala Plum	Flacourtia Cataphracta	„ 0 12 0	„ 0 4 0
Papaw	Carica Papaya	„ „	„ 0 4 0
Peach	Amygdalus Persica	„ 1 8 0	„ 0 8 0
Pear (dessert)	Pyrus communis	„ 2 0 0	„ 2 0 0
Phulsa	Grewia Asiatica	„ „	„ 0 6 0
Pine Apple, common kinds	Ananassa sativa	„ „	„ 0 2 0
Ditto, rare sorts	Ditto	„ „	„ 1 0 0
Pomegranate	Punica granatum	„ 1 0 0	„ „

JOURNAL

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OF

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ORIGINAL COMMUNICATIONS.

"A body of men engaged in the same pursuit form a joint stock of their information and experience, and thereby put every individual in possession of the sum total acquired by them all."—REV. DR. WILLIAM CAREY.

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JOURNAL

Agricultural and Horticultural Society

OF

INDIA.

Prize Essay on the Cultivation and Manufacture of Tea in India.
By Lieutenant-Colonel EDWARD MONEY.

Premium: Three Hundred Rupees and the Grant Gold Medal.

PREFACE.

THE following Essay was written with *firstly*, the object of competing for the Gold Medal and the Money Prize offered by the Agricultural and Horticultural Society of India, for the best Treatise on the Cultivation and Manufacture of Tea; and *secondly*, with the view of arranging the hundreds of notes on these subjects, which, in the course of eleven years, I had collected.

During these years I have been a Tea Planter, making first for myself and others a Garden in the Himalayas, and for the last six years doing the same thing for myself in the Chittagong district.

Whenever I have visited other plantations, (and I have seen a great number in many districts) I have brought away notes of all I saw. Up to the last, at every such visit, I have learnt *something*. If rarely nothing to follow, something at least, to avoid. I have now tested all and every thing, connected with the cultivation and manufacture of Tea, by my own experience, and I can only hope, that what I have written will be found useful to an

industry, destined, yet I believe, in spite of the late panic, the natural result of wild speculation, to play an important part in India.

I have endeavoured to adapt this Essay to the wants of a beginner, as there are many of that class now, and may yet be more in days to come, who must feel, as I often have, the want of a really practical work on Tea.

To those who have Tea properties in unlikely climates, and unlikely sites, I would say two words. No view I have taken of the advantages of different localities, *can* in any way affect the results of enterprizes already entered upon. But if the note of warning, sounded in the following pages, checks further losses in Tea, already so vast, while it fosters the cultivation on remunerative sites, I shall not have written in vain.

SUNGOO RIVER PLANTATION;
CHITTAGONG,
November 1870.

EDWARD MONEY.

CHAPTER I.

PAST AND PRESENT FINANCIAL PROSPECT OF TEA. GOVERNMENT ACTION.

Will tea pay? Certainly, on a suitable site, and in a good tea climate; equally certainly *not*, in a bad locality with other drawbacks.

Why then has not tea paid hitherto? Simply because nothing will pay, which is embarked on without the requisite knowledge, and this has been pre-eminently the case with tea.

NOTHING was known of tea formerly, when every body rushed into it; not much is known now. Still with those drawbacks, and many others, the enterprise has survived, and it is very certain, the day will never come, that tea cultivation will cease in India.

I believe there is nothing will pay better than tea, if embarked on with the necessary knowledge in suitable places, but failing either of these, success must not be hoped for.

It was madness to expect aught, but ruin, under the conditions which the cultivation was entered on in the tea-fever days. People who had failed in every thing else, were thought quite competent to make plantations. 'Tis true, tea was so entirely a new thing at that time, but few could be found who had any knowledge of it, still had managers with some practice in agriculture been chosen, the end would not have been so disastrous. But any one, literally any one, was taken, and tea planters in those days were a strange medley of retired or cashiered army and navy officers, medical men, engineers, veterinary surgeons, steamer captains, chemists, shop-keepers of all kinds, stable-keepers, used-up police men, clerks, and goodness knows what besides.

Is it strange the enterprize failed in their hands? Would it not have been much stranger if it had not?

This was only one of the many necessities for failure. I call them "necessities" as they appear to have been so industriously sought after in some cases. I must detail them shortly, for to expatiate on them, would fill a book.

No garden should exceed 100 acres under tea. If highly cultivated, one of even half that size will pay enormously, far better than 500 acres of tea with low cultivation. Add say 300 acres for charcoal, &c., making, 400 acres the outside area that can be required, and the outside that should ever have been purchased for any one estate. Instead of this, individuals and Companies rushing into tea, bought tracts of five, ten, fifteen, and twenty thousand acres. The idea was, that though it might not be all cultivated, by taking up so large an area all the local labour, where there was any, would be secured. Often, however, these large tracts were purchased, where local labour there was none, and what the object there was is a mystery. I conceive, however, there was a hazy

idea, that *if* 500 acres paid well, 1,000 would pay double, and that eventually, even two or three thousand acres would be put under tea and make the fortunate possessor a *millionaire.* In short there were no bounds—in fancy—to the size a garden might be made, and thus loss No. 2 took place, when absurdly large areas were bought of the Government, and large areas cultivated.

The only fair rules, for the sale of waste lands, were those of Lord Canning, which the Secretary of State at home, who could know nothing of the subject, chose to modify and upset. Instead of Rs. 2-8 per acre, for all waste lands, (by no means a low price, when the cost of land in the Colonies is considered) and that the applicant for the land, (who had, perhaps, spent months seeking for it) should have it; the illiberal and unjust method of putting the land up to auction, with an upset price of Rs. 2-8 was adopted, the unfortunate seeker, finder, and applicant, through whose labour the land had been found, having no advantage over any other bidder. The best, at least the most successful plan, in those days, though as unfair and illiberal as the Government action, was to wait till some one, who was supposed to know what good tea land was, applied for a piece, and then bid half an anna more than he did, and thus secure it. It *paid* much better than hunting about for one-self, and it was kind and considerate on the part of Government to devise the plan.

In those fever days, with the auction system, lands almost always sold far above their value. The most absurd prices, Rs. 10 and upwards per acre, were sometimes paid for wild jungle lands. Tracts, which natives could have, and in some cases *did* lease from Government for inconceivably small sums, representing say at 30 years purchase, 4 annas per acre, were put up for auction with a limit of 2-8, and sold perhaps at 8 or 10 Rs. per acre. Had the Government given lands *gratis* to tea cultivators, the policy would have been a wise one. To do what they did was scarcely acting up to their pro-

fessed wish " to develop the resources of the country," for Rs. 2, or at the most Rs. 2-8 per acre, is the very outside value of any waste land in India.

Security of title, it is generally thought, is one of the advantages of buying land from the State; but I grieve to state, my experience is that the reverse is the case, and will so remain until the following is done.

First.—That Government should learn *what is and what is not theirs to sell.* Such an absurdity then, as Government ascertaining years after the auction, that they had sold lands they had no right to sell, could not be.

Secondly.—That before land is sold, it be properly surveyed, and demarkated; and what might so easily have been done, and which alone would have compensated for much of bad procedure in other respects, that the simple and obvious plan, before the sale, of sending a European official to show the neighbouring villagers and intending purchasers, the boundaries of the land to be sold be resorted to.

This last simple expedient would have saved some grantees years of litigation, and many a hard thought of the said grantees against the Government. It would naturally occur to any one, at all conversant with the subject; but *alas* in India, this is often not the condition under which laws are made.

But there is another difficulty at the back of all this.

Though the Waste Land Rules enact that the Government, and not the grantee, shall be the defendant in any claim for land, within a lot sold, practically the said enactment in no way saves grantees from litigation. Claimants for land always plead that it is *not* within the boundaries of the land sold, and the *ergo* grantee is made the defendant to prove, that it *is*. The villagers never having been shown the boundaries by any Government official, (for it is not enacted in the Waste Land Rules) the question whether the land claim is within or without the boundaries is an open one, not

always easily decided, and the suit runs its course.

I even know of cases, where, though survey has been charged for at the exorbitant rate of four annas an acre, the outer boundaries of the lot have never been surveyed at all, but merely copied from old Collectorate maps, which showed the boundaries between the zemindaree and waste lands. * Is it strange then, if buying lands from Government is often buying litigation, worry, loss of time, and money ?

In many countries, for example Prussia (there I know it is so, for I have tested it again and again) there are official records, which can, and do show, to whom any land in question belongs. This may scarcely be practicable in India, but surely the question of title, being as it is, in a far worse state in India than in most countries, any change would be for the better. Anyhow the present mode the Government adopts in selling lands, is a grievous wrong to the purchasers. Words cannot describe the worry and loss some have suffered thereby, and it might all be so easily avoided.

I have above detailed two of the drawbacks tea had to contend with in its infancy; the absurdly high price paid for land was the third. The title-difficulty is as bad to-day as formerly.

Again, Companies and proprietors of gardens, will, to have large areas under cultivation, give their managers simple orders to extend, not judiciously, but in any case. What was the result ? Gardens might be seen in those days, with 200 acres of so-called cultivation, but with 60 or even 70 per cent. vacancies, in which the greater part of the labour available was employed in cleaning jungle for 100 acres further extension in the following Spring. I have seen no garden in Assam or Cachar, with less than 20 per cent. vacancies, many with far more, and yet most of them were extending. I do

* I need scarcely observe it is impossible to define lands, from maps alone, without the field-book.

not believe *now* any garden in all India exists with less than 12 per cent. vacancies, but a plantation as full as this did *not* exist formerly.

As the expenditure on a garden is in direct proportion to the area cultivated, and the yield of tea likewise in direct proportion to the number of plants, it follows the course adopted was the one exactly calculated to entail the greatest expenditure for the expected yield. This unnecessary, this wilful extension, was the fourth and a very serious drawback.

Under this head, the fourth drawback, may also be included the fact that the weeds in all plantations were *a-head* of the labour, that is to say, that gardens were not kept clean. This is more or less even the case to-day; it was the invariable rule then. The consequence was two-fold, *first*, a small yield of tea, *secondly*, an increased expenditure; for it is a fact that the land 50 men can keep always clean, if the weeds are never allowed to grow to maturity and seed, will take nearer 100 if the weeds once get a-head. The results too differ widely: in the first case, the soil is always clear, in the second, clear only at intervals. The first, as observed, can be accomplished with 50, the latter will take nearly double the men.

The fifth drawback I shall advert to again later, *viz.*, the selection of sloping land, often the steepest that could be found, on which to plant tea. The great mischief this entailed will be fully described elsewhere. It was the fifth, and not the least, antagonistic point to success.

Number six was the difficulty, in the transport of seed to any new locality, for nine times out of ten a large proportion failed; and again the enormous cost of tea seed in those days, Rs. 200 a maund, (Rs. 500 at least, deducting what failed, was its real price). This item of seed alone entailed an enormous outlay, and was the sixth difficulty tea cultivation had to contend with. It was, however, a source of great profit to

the old plantations, and principally accounts for the large dividends paid for years by the Assam Company.

Again, many managers at that time had no experience to guide them in the manufacture of tea, each made it his own way, and often turned out most worthless stuff. There is great ignorance on the subject at the present time, but those who know *least* to-day, know *more* than the best informed in the tea-fever period. Indian tea was a new thing then, the supply was small and it fetched comparatively much higher prices than it does now. Still much of it was so bad that the average price all round was low.

Tea manufacture, moreover, as generally practised then, was a much more elaborate and expensive process than it is now. This will be explained further on, under the head of Tea manufacture; I merely now state the fact, in support of the assertion that the bad tea made in those days, and the expensive way it was done, was the 7th hindrance to successful tea cultivation.

Often, in those days, was a small garden made of 30 or 40 acres, and sold to a Company as 150 or 200 acres. I am not joking. It was done over and over again. The price paid, moreover, was quite out of proportion to even the supposed area. Two or three lakhs of rupees (£20,000 or £30,000) have been often paid for such gardens, when not more than two years old, and 40 per cent. of the existing area, vacancies. The original cultivators "retired," and the Company carried on. With such a drag upon them (apart from all the other drawbacks enumerated), could success be even hoped for? Certainly not.

I could tell of more difficulties the cultivation had to contend with at the outset, but I have said enough to show, as I remarked, "that it was not strange tea interprize failed, inasmuch as it would have been much stranger if it had not."

Do any of the difficulties enumerated exist now, and may a person embarking in tea to-day hope, with reasonable hope, for success? Yes, certainly, I think as regards the latter;—the former let us look into.

People, who understand more or less of tea, are plentiful, and a good manager, who knows tea cultivation and tea manufacture well, may be found. There is no need to buy more than 400 acres of land, for 100 acres and no more is wanted for the garden, and at 2-8 per acre (there is no competition) the outlay for land would be small.

The plantation can be limited to 50 acres, until it is quite full, and then gradually extended to 80 or 100.

There is plenty of flat land to be got, so no evil from slopes need be incurred.

Tea seed is plentiful, and can be purchased near at say Rs. 10 per maund. No loss, from long transport, or bad seed, will thus occur.

The manufacture of tea (though still progressing) is simple, economical, and more or less known. Anyhow, a beginner now will commence where others have left off.

Of course to buy a made garden cheap is better than to make one, and enough of the tea-panic remains to make it possible; but the result in this case is of course no criterion of what profit may be expected from tea cultivation.

As many of the items to be calculated under the heads of cultivation, manufacture, and receipts, will be better understood, after details on those subjects are gone into, I shall reserve the consideration of "how much profit tea can give" to the end of this treatise.

CHAPTER II.

LABOUR, LOCAL AND IMPORTED. GOVERNMENT ACTION.

When the very large amount of labour required to carry on a plantation is considered, it is evident that facilities for it

are a *sine qua non* to success. Assam and Cachar, the two largest tea districts, are very thinly populated, and almost entirely dependent on imported labour. The expense of this is great, and it is the one; consequently, a great drawback to those provinces. The only districts with a good tea climate and abundance of local labour, are Chittagong and the Terai below Darjeeling.* Several other places have a good supply of local labour but then their climates are not very suitable.

Each coolie imported costs Rs. 30 and upwards (it used to be much more) ere he arrives on the garden, and does any work. After arrival he has to be housed; to be cared for and physicked when sick; to be paid when ill as when working; to have work found for him or paid to sit idle when there is no work (often the case in the cold-weather) and in addition to all this, every death, every desertion, is a loss to the garden of the whole sum expended in bringing the man or woman. Contrast this with the advantages of local labour. In many cases no expense for buildings is necessary, as the labourers come daily to work from adjacent villages, and in such cases no expense is entailed by sick men, for these simply remain at home. There is no loss by death or desertions. When no work is required on the garden, labour is simply not employed. All this makes local labour, even where the rate of wages is high, very much cheaper than imported.

The action of Government, in the matter of imported labour, has much increased the difficulties and expense necessarily attendant on it. It is a vexed, and a very long question, which I care not to enter into minutely, for it has been discussed already *ad nauseam*; still I must put on record my opinion, after looking very closely into it, that the Government has not acted wisely, inasmuch as any State interference, in the relations of employer and employed, (outside

* The Terai below Darjeeling has, I am told, a good deal of local labour, still not, I imagine, as much as Chittagong.

the protection which the existing laws give) is a radical mistake. As for the last law passed on the subject, to the effect that a coolie who has worked out his agreement and voluntarily enters into a new one, shall be, as before, under Government protection and his employer answerable as before to Government, for the way he is housed; treated when sick, &c., &c., it is not easy to see why such enactments are more necessary in his case, than in that of any other hired servant, or labourer throughout all India.

All evidence collected, all enquiries made, tend to show, that coolies are well treated on Tea Estates. It is to the interest of the proprietors and managers to do so, and self-interest is a far more powerful inducement than any the Government can devise. The meddling interference the imported coolie laws enact, the visits of the "Protector of Coolies"* to a garden, all conduce to destroy the kind feelings which should (and in spite of these hindrances often do) exist between the proprietor or manager and his men. I do not hesitate in my belief, that imported coolies on tea plantations would be better off in many ways were all Government interference abolished.

I do not decry Government action, to the extent of seeing the coolies understand their terms of engagements and are cared for on the journey, to the tea districts; but once landed on the garden all Government interference should cease.

The idea of the State laying down how many square yards of jungle each coolie shall clear in a day, how many square feet he shall dig, &c., &c., &c.! Can *any* certain rates be laid down for such work? Is all jungle the same, all soil the same, and even if such rates *could* be laid down, how can

* What a designation! Who invented it, I wonder? A clever man, doubtless, for Government interference was probably his hobby, and he quickly perceived the very title would, more or less, render the office necessary!

the rules be followed? Bah! they are *not*, never will be, and the whole thing is too childish for serious discussion.

It is not difficult to sit at a desk, and frame laws and rules that look feasible on paper. It is quite another thing to carry them out. Our legislation is a crying evil in India, but there is still a worse, namely legislation and official action, on subjects of which the said officials are utterly ignorant.

I have said enough to show imported labour cannot vie with local, nor would it do so were all the evils of Government interference removed. I therefore believe tea property in India will eventually pay best where local labour exists. This will naturally be the case, when other conditions are equal, but so great are the advantages of local labour, I believe it will also be the case, in spite of *moderate* drawbacks.

CHAPTER III.

TEA DISTRICTS AND THEIR COMPARATIVE ADVANTAGES. CLIMATE, SOIL, &C., IN EACH.

THE Tea Districts in India, that is where tea is grown in India to-day are—

1. Assam.
2. Cachar and Sylhet.*
3. Chittagong.
4. Terai below Darjeeling.
5. The Dehra Dhoon.
6. Kangra, (Himalayas).
7. Darjeeling, (Himalayas).
8. Kumaon, (Himalayas).
9. Hazareebaugh.
10. Neilgherries, (Madras Hills).

* These are virtually one, and I shall allude to both as Cachar.

In fixing on any district to plant tea in, four things have to be considered, *viz.*, soil, climate, labour, and means of transport, and when the district being selected, a site has to be chosen. All but the second of these has to be considered again, and further lay of land, nature of jungle, water, and sanitation.

I will first then discuss generally the tea districts given above, as regards the advantages of each for tea cultivation. As some of the remarks I shall make are hearsay, and some the results of personal experience, and it would not be convenient to state which they are each time, I may mention that I have seen, and studied tea gardens, in all the districts named, except Nos. 4, 5, 7, 9, 10. What I know of these last is from what I have read, what is generally known of their climates, and what planters from each have told me.

Before, however, comparing each district, we should know what are the necessities of the tea-plant, as regards climate and soil. Tea, especially the China variety, will grow in very varying climates and soils, but it will not flourish in all of them, and if it does not flourish, and flourish well, it will certainly not pay.

The climate required for tea is a hot damp one. As a rule a good tea climate is not a healthy one. The rain-fall should not be less than 80 to 100 inches, per annum, and the more of this that falls in the early part of the year the better. Any climate which though possessing an abundant rain-fall suffers from drought in the early part of the year, is not *cæteris paribus* so good, as one where the rain is more equally diffused. *All* the tea districts that would yield better, with more rain in February, March, and April, and therefore some, where fogs prevail in the mornings at the early part of the year, are so far benefitted.

As any drought is prejudicial to tea, it stands to reason hot winds must be very bad. These winds argue great aridity and the tea plant luxuriates in continual moisture.

The less cold weather experienced, where tea is, the better for the plant. It can stand, and will grow, in great cold (freezing point, and lower in winter is found in some places where tea is), but I do not think it will ever be grown to a profit on such sites. That tea requires a temperate climate was long believed, and acted upon, by many to their loss. The climate *cannot* be too hot for tea, if the heat is accompanied with moisture.

I have heard that tea will not flourish lower than about the 15th or 18th degree of latitude, even if all the other necessities of climate, heat, moisture, and the absence of a low degree of the temperature in the winter be there. Something in the climate near the equator is said to be hurtful. I have never seen tea lower than 22,° so do not speak from experience. Tea grown in temperate climes, such as moderate elevations in the Himalayas, is quite different to the tea of hot, moist climates such as Eastern Bengal. Some people like it better, and I believe the flavour is more delicate ; but it is very much weaker and the value of Indian tea (in the present state of the home market where it is principally used for giving "body" to the washy stuff from China) consists in its strength. Another all-important point, in fixing on a climate for tea is the fact, that apart from the strength, the yield is double in hot, moist climes, what it is in comparatively dry and temperate ones. A really pleasant climate to live in cannot be a good one for tea. I may now discuss the comparative merits of the different tea districts.

ASSAM.

This is the principal home of the indigenous plant, and were it not for scarcity of labour, no other district could vie with it. The climate in the northern portions is perfect, superior to the southern, as more rain falls in the spring. The climate of the whole of Assam, however, is very good for

tea, inasmuch as while there is plenty of moisture, the rain is comparatively light in the rainy season, and in this respect better than Cachar where, in the rainy months, too much rain falls. The tea plant yields most abundantly, when hot sunshine and showers intervene. For climate then I accord the first place to Northern Assam. Southern Assam is as observed a little inferior.

The soil of this Province is decidedly rich. In many places there is a considerable coating of decayed vegetation on the surface, and inasmuch as all places where tea has been, or is likely to be planted, it is strictly virgin soil, considerable nourishment exists. The prevailing soil also is light and friable, and thus with the exception of the rich oak soil of the Himalayas, and perhaps the soil in the Terai under Darjeeling, Assam in this respect, but with those two exceptions, is second to none.

As regards labour we must certainly put it the last on the list. The Assamese, and they are scanty, won't work, so the planters, with few exceptions, are dependant on imported coolies, and inasmuch as the distance to bring them is enormous, the outlay on this head is large, and a sad drawback to successful tea cultivation.

The Berhampootra, that vast river which runs from one end of Assam to the other, gives an easy mode of export for the tea, but still owing to the distance from the sea board, it cannot rank in this respect as high as some others.

CACHAR.

The indigenous tea is found in a part of this Province. The climate is inferior to Assam, because the rains are too heavy, but I think it takes the second place. In one and an important respect, it is even better than Northern Assam, more rain falls in the spring.

The soil is not equal to Assamese soil, it is more sandy, and lacks the power. Again, there is much more flat land

fit for tea cultivation in Assam, and there can be no doubt as to the advantage of level surfaces.

As regards transport, Cachar has the advantage, for it has equally a water-way, and is not so distant from Calcutta.

The labour aspect is much the same in the two provinces, both being almost entirely dependant on imported coolies; but Cachar is nearer the labour fields than Assam.

However, after discussing separately, the advantages of each province, I propose to draw up a tabular statement, which will show at a glance the comparative merits of each, on each point discussed.

Chittagong.

This is a comparatively new locality for tea. The climate is better than Cachar in the one respect that the rains are somewhat lighter during the rainy months, but inferior in the more important fact that much less rain falls in the spring. In this latter respect it is also inferior to Assam, particularly to Northern Assam. I therefore as to climate give it the third place. There is one part of Chittagong, the Hill Tracts, (tea has scarcely been much tried there yet) which, in the fact of spring rains, is superior to other parts of the province, as also in soil, for it is much richer there. On the whole, however, Chittagong must yield the palm to both Assam and Cachar, on the score of climate, and also I think of soil. For though good rich tracts are occasionally met with, they are not so plentiful as in the two last-named districts. Always, however, excepting the Hill Tracts of Chittagong, there the soil is, I think, quite equal to either Assam or Cachar.

As regards labour (a very essential point to successful tea cultivation) Chittagong is most fortunate. With few exceptions (and those only partial) all the plantations are carried on with local labour, which excepting for about two months, the rice-time, is abundant.

For transport (being on the coast with a convenient harbour, a continually increasing trade, ships also running direct to and from England) it is by far the most advantageously situated of all tea localities.

Chittagong possesses another advantage over all other tea districts in its large supply of manure. The country is thickly populated, and necessarily large herds of cattle exist. The natives do not use manure for rice (almost the sole cultivation) and, consequently, planters can have it almost for the asking. The enormous advantages of manure in tea cultivation, are not yet generally appreciated. It will certainly double the ordinary yield of a tea garden. A chapter is devoted to this subject.

TERAI BELOW DARJEELING.

I have not seen this but have heard it *very* favourabl spoken of. The climate is probably nearly equal to Cach and the soil better. In the latter respect it is probably al superior to Chittagong. Planters are better off there f labour, than in either Assam or Cachar, but not so well off in Chittagong.

As regards transport, it is of course very badly situated, though, if ever a railroad is made to the foot of the Darjeeling Hills, this difficulty will be got over. On the whole, I should think this district a *very* promising one for tea.

THE DEHRA DHOON.

I have heard the first tea in India was planted here. The lucky men, two officers, who commenced the plantation, sold it, I believe in its infancy to a Company for 5 lakhs of rupees. What visions did tea hold forth in those days !

In climate, the Dehra Dhoon, is far, far from good. The hot dry weather of the North-West is not at all suited to the tea plant. Hot winds shrivel it up, and though it recovers

when the rains come down, it cannot thrive in such a climate. One fact will, I think, prove this. In favourable climates, with good soil, and moderate cultivation, 18 flushes or crops may be taken from a plantation in a season. With like advantages, and *heavy* manuring, 22 or even more may be had. In the " Selections from the Records of the Government of India" on Tea published in 1857 (a book to which many owe their ruin) the following appears, showing how small are the number of flushes in the North-West.

Method of gathering Tea Leaves.—" The season for gathering leaves generally commences about the beginning of April, and continues until October; the number of gatherings varies, depending on the moistness and dryness of the season. If the season be good, that is to say, if rain falls in the cold weather and spring and the general rains be favorable, as many as five gatherings may be obtained. These, however, may be reduced to three general periods for gathering, *viz.*, from April to June, from July to 15th August, and from September to 15th October. If the season be a dry one, no leaves ought to be taken off the bushes after the 1st October, as by doing so they are apt to be injured. If, however, there are good rains in September, leaves can be pulled until the 15th October, but no later, as by this time they have got hard and leathery and not fitted for making good teas, and as it is necessary to give the plants good rest in order to recruit. Some plants continue to throw out new leaves until the end of November; but those formed during this month are generally small and tough."

Three general gatherings.

When this was written, the experience detailed related to Dehra Dhoon, the Kumaon, and Kangra Gardens, and we see that five flushes or gatherings are thought good. It however makes matters in this respect (far from a general fault in the said " Records") worse than they are. Ten and twelve flushes, with *high* cultivation, can be got in the North-West.

But what is this as against 20 and 25 ?

Labour is plentiful and cheap. The great distance from the Coast, makes transport very expensive.

KANGRA.

This is a charming valley, with a charming climate, more favourable to tea than Dehra Dhoon, still it is far from a tea climate. It is too dry and too cold. The soil is good for tea, better than that of the Dhoon, but inferior to some rich soils in the Himalayan oak forests. Local labour is obtainable at cheap rates. Distance makes transport, for export, very difficult ; but more or less of a local market exists in the Punjab, and a good deal of tea is bought at the fairs, and taken away by the wild tribes over the border. With the limited cultivation there, I should hope planters will find a market for all their produce. Manure must be obtainable (manure had not been thought of for tea when I visited Kangra) and if liberally applied, it will increase the yield greatly.

Kangra is strictly a Himalayan district, but the elevation is moderate, if I remember right, about 3,000 feet, and the land is so slightly sloping it may almost be called level. A great advantage this over the steep lands, on which most of the Himalayan gardens, many in Cachar, and some in Assam and Chittagong are planted.

Kangra is *not* the place for a man who wants to make money by tea ; but for one who would be content to settle there, and content to make a livelihood by it, a more desirable spot with a more charming climate could not be found. Land, however, is not easily procured.

DARJEELING.

I have never been there. The elevation of the station, 6,900 feet is far too great, but plantations lower down are, I believe, doing well, (that is well for hill gardens). The

climate, like all hill climates, is too cold, but there is rich soil, and cheap labour, to make up for this. As regards transport, the Darjeeling plantations have the same difficulties as were detailed for the Terai below Darjeeling, with the additional expense of sending the tea down the hill. Like elevations in Darjeeling and Kumaon are in favour of the former, *first*, because the latitude is less; *secondly*, because Darjeeling Gardens are mostly on or near the outer slopes, and these are not so cold, as slopes and valleys far in the hills, where many of the Kumaon Gardens are situated. I believe, therefore, that the hill plantations of Darjeeling have a better chance of paying than the gardens in Kumaon, but, as stated before, no elevated gardens, that is none in the Himalayas, have any chance in the race against plantations in the plains, always providing the latter are in a good tea climate.

Gardens, barely removed above the Terai (and I hear there are such in Darjeeling) can scarcely be called "elevated," and for them the remarks applied to the Terai are more fitting. As a broad rule it should be recognized, that the lower tea is planted in the Himalayas, the better chance it has.

KUMAON.

It was in this district (a charming climate to live in, with magnificent scenery to gaze at) I first planted tea in India, and I much wish for my own sake, and that of others, I had not done so. I knew nothing of tea at the time, and I thought a district, selected by Government, for inaugurating the cultivation, must necessarily be a good one. No hill climate *can* be a good one for tea; but the inner parts of Kumaon, very cold, owing to its elevation, high latitude, and distance from the plains, is a peculiarly bad one. Yet there it was Government made nurseries, distributed seed gratis, recommended the site for tea (see the "Records" alluded to (and led many on to their ruin by doing so. The inten-

tion of the Government was good, but the officers in charge of the enterprize were much to blame, perhaps not for making the mistake at first (no one *at the first* knew what climate was suitable) but for perpetuating the mistake, when later, very little enquiry, would have revealed the truth. I believe it was guessed at by Government officials long ago, but it was easier to sing the old tune, and a very expensive song it has proved to many.*

I need scarcely, after this, add I do not approve of Kumaon, for tea. An exhilarating and bracing climate for man, is not suited to the tea plant. The district has one solitary advantage—rich soil. I have never seen richer, more productive land, than exists in some of the Kumaon oak forests, but even this cannot, in the case of tea, counterbalance the climate. Any crop, which does not require much heat and moisture will grow to perfection in that soil. Such potatos as it produces! Were the difficulties of transport not so great, a small fortune might be made by growing them.

Could any part of Kumaon answer for tea it would be the lower elevations, in the outer ranges of the hills, but these are precisely the sites that have *not* been chosen. Led, as in my own case, partly by the Government example, partly by the wish to be *out* of sight of the "horrid plains," and *in* sight of that glorious panorama the snowy range, planters have chosen the interior of Kumaon. Some wisely (I was not one of them) selected low sites, valleys, sheltered from the cold winds, but even their choice has not availed much. The frost in winter lingers longest in the valleys, and though doubtless the yield there is larger, owing to the increased heat in summer, the young plants suffer much in the winter.

* Is it possible that the continued deception (it was nothing less) was owing to the fact Government had gardens to sell there? They were advertized for sale a long time at absurd prices. Some are sold (the purchasers are to be pitied) the cheapest thing for Government to do is to abandon the others.

The outer ranges, owing to the heat radiating from the plains, are comparatively free from frost, but there again the soil is not so rich. Still they would unquestionably be preferable to the interior.

Labour is plentiful in Kumaon, and very cheap, Rs. 4 per mensem. Transport is very expensive. It costs, not a little, to send tea from the interior, over divers ranges of hills, to the plains. It has then some days journey by cart, ere it meets the rail, to which 1,000 miles of carriage, on the railroad, has to be added.

The long and short of the matter is, Kumaon is *not* a district in which tea can ever be grown to a profit. Some plantations, there are, which will I hope and believe pay their way, but they are quite the exceptions, and *they* cannot, I believe, ever pay a fair interest on the money laid out in making them. Now that these, (the exceptional ones) are made, it may be cheaper to keep them up than to abandon them, but as for the others (the Government Plantations included) the sooner they are resigned the better. They can only be carried on at a loss.

Gurhwall is next to Kumaon, and so similar, I have not thought it necessary to discuss it separately. The climate is the same, the soil as a rule not so good. There is one exception though, a plantation near " Lohla," the teas of which (owing I conceive to its peculiar soil) command high prices in the London market. The gardens, both in Kumaon and Gurhwall, have been generally much better cared for than those in Eastern Bengal. As a rule they are private properties, managed by the owners. But no care or attention (and the one or two Companies that exist there have first-rate men as managers) can counterbalance a prejudicial climate.

HAZAREEBAUGH.

The climate is too dry, and hot winds, though not for ong, are felt there. A great compensation though is labour,

it is more abundant, and cheaper in this District, than in any other. The carriage is all by land, and it is some distance to the rail; still as will be seen by the comparative table further on, it is better off in this respect than some others. I have not seen the tea gardens at Hazareebaugh, but I do not believe they can ever vie with those in Eastern Bengal, inasmuch as the climate is very inferior.

The soil is light and friable, but not equal to some other districts.

NEILGHERRIES.

This is I have heard too near the equator for the tea plant. The climate, otherwise, is superior to the Himalayan, for the frost is very slight. Were there however more heat there in summer, it would be better. It is a delightful place to live in, but I much question the success of tea there. The equable and temperate climate seems all that is required for Cinchona, but an equable and temperate climate is not suited to tea.

I have heard the soil is good, but have no certain information on this head. Not much difficulty can exist in the way of transport.

Having now discussed each district, I give in further elucidation Meteorological Tables of the principal ones. For those, not mentioned in the tables, I have failed to acquire the necessary information.

My thanks are due to Dr. Coates at Hazareebaugh for his kindness in supplying me with much of the data from which the following tables are framed :

Table of Elevation and Temperature of Tea Localities.

N. B.—The exact temperature of other Tea Districts not being known, I have confined myself to these; but general remarks on the elevation and temperature of other Tea localities will be found elsewhere.

Districts.	Place.	Elevation in feet.	Details.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	D. J. F.	M. A. M.	J. J. A.	S. O. N.	Year.
Assam.	Goalparah ..	386	Monthly Temp	61·7	63·0	72·6	77·6	76·0	80·3	82·1	81·6	80·5	77·5	69·0	64·6	63·1	75·4	81·3	75·6	73·8
			Do Max	77·2	87·9	94·0	97·0	91·0	91·0	92·0	91·5	92·0	89·0	84·3	78·3					
			Do Min	49·0	48·0	57·2	62·6	67·0	70·0	73·7	73·0	70·1	62·3	50·8	50·0					
	Gowhatty ..	134	Monthly Temp	63·6	67·6	74·5	77·4	80·4	81·8	83·0	82·9	82·2	79·2	71·1	65·5	65·6	77·4	82·6	77·5	75·8
	Seebsaugor ..	370	Monthly Temp	60·0	64·1	69·3	73·8	78·5	82·4	83·6	83·5	83·1	78·3	69·4	62·4	62·2	73·7	83·2	76·9	74·0
	Deebroghur ..	396	Monthly Temp	62·2	63·4	71·3	72·7	77·1	80·7	83·7	81·8	81·0	75·6	67·4	61·0	62·2	73·7	82·1	74·7	73·2
Cachar.	Cachar ..	76	Monthly Temp	62·9	66·6	73·4	76·8	80·9	82·2	83·3	81·7	81·2	79·6	70·6	65·4	64·9	77·0	82·4	77·1	75·3
Chitta-gong.	Chittagong ..	101	Monthly Temp	68·5	72·3	80·5	83·5	84·5	84·0	82·2	82·3	83·0	81·6	73·7	68·9	69·9	82·8	82·8	79·4	78·7

Darjeeling.	Darjeeling ..	[illegible]52	Monthly Temp	42·2	43·8	52·0	58·7	62·1	63·7	64·9	64·4	63·0	57·3	49·4	44·7	43·5	57·6	64·3	58·4	55·9
			Do Max	62·0	66·0	72·0	78·0	79·0	79·0	79·0	75·0	80·0	78·0	69·0	60·0					
			Do Min	32·0	28·0	39·0	48·0	48·0	57·0	58·0	59·0	57·0	44·0	38·0	33·0					
Chota Nagpore.	Hazareebaugh	2010	Monthly Temp	62·7	67·1	73·7	85·6	88·6	83·8	77·8	79·3	77·5	72·6	64·8	61·4	63·7	82·6	80·3	71·6	74·5
			Do Max	82·0	91·0	94·0	107·0	110·0	103·0	89·0	88·0	87·0	84·0	78·0	76·0					
			Do Min	44·0	46·4	55·0	67·0	72·0	71·0	71·0	73·0	70·0	59·0	52·0	44·0					
Nilgherries.	Ootacamund	7490	Monthly Temp	51·5	52·8	57·3	60·1	60·8	57·9	55·8	56·1	56·4	55·9	53·9	51·9	52·1	59·4	56·6	55·4	55·9

—The letters in the columns, between December and the year, refer to months, thus, D. J. F. is December, January, February. The figures show the average temperature during those months.

Table of Latitude, Longitude, and Rain-fall of Tea localities.

N. B.—The exact rain-falls of other Tea Districts not being known, I have confined myself to these, but general remarks on the rain-fall in other Tea localities will be found elsewhere.

Districts.	Place.	Latitude.	Longitude.	Detail.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
Assam.	Goalparah ..	26° 11′	90° 36′	Average rain, several years ..	0·42	0·76	1·84	4·85	11·72	23·72	21·33	12·69	10·03	5·61	0·39	0·20	94·44
				Days rain fell in 1869	2	2	4	8	19	24	22	18	15	5	Nil	Nil	119
	Gowhatty ..	26° 5′	91° 43′	Average rain, several years ..	0·70	1.43	1·48	7·27	10·92	13·29	13·08	11·93	6·82	3·20	0·47	0·12	70·76
				Days rain fell in 1869	2	2	4	8	16	16	9	10	14	2	Nil	1	84
	Seebsaugor ..	2[illegible]° 2′	94° 39′	Average rain, several years ..	1·18	2·43	3·77	10·15	11·04	15·56	14·87	13·88	11·13	4·46	1·29	0·69	90·45
				Days rain fell in 1869	11	9	10	13	22	18	19	23	17	8	Nil	2	147
Cachar.	Cachar ..	24° 48	92° 43′	Average rain, several years ..	0·50	3·53	6·09	12·69	16·12	19·55	24·58	16·84	13·90	7·77	7·03	0·79	123·39
				Days rain fell in 1869	2	9	10	16	18	20	18	25	19	8	Nil	Nil	145
[illegible]gong.	Chittagong ..	22° 20′	91° 44′	Average rain, several years ..	0·37	1·62	1·31	5·46	9·42	22·92	22·54	23·04	13·01	5·93	2·30	0·55	108·47
				Days rain fell in 1869	1	7	3	4	14	15	21	25	17	5	Nil	1	113

Chitta.	Hill Tracts ..	?	?	Rain in 1869	Nil	1·90	1·50	12·55	9·00	12·50	18·20	14·30	12·70	5·70	Nil	0·50	88·85
				Days rain fell in 1869 ..	Nil	4	4	7	13	16	22	19	19	4	Nil	1	109
Darjeeling.	Darjeeling ..	27° 3′	88° 18′	Average rain, several years ..	0·76	1·60	1·65	3·62	7·01	27·50	29·40	29·09	18·06	6·56	0·20	0·14	129·59
				Days rain fell in 1869 ..	2	3	5	9	17	23	26	22	24	7	1	2	148
	*Buxar { Bhootan ..	?	?	Rain in 1869	0·80	2·00	1·50	6·60	25·30	27·30	46·50	83·50	46·50	9·60	?	2·40	252·00
	*Buxar { Dooars ..			Days rain fell in 1869 ..	3	3	5	7	15	19	25	28	22	5	?	?	?
Chotta Nagpore.	Hazareebaugh ..	24° 0′	85° 20′	Average rain, several years ..	0·42	0·52	0·75	0·42	1·37	10·99	14·63	11·44	6·26	3·51	0·19	0·02	50·52
				Days rain fell in 1869 ..	4	Nil	7	Nil	5	11	24	16	21	9	Nil	1	98

* Unable to get the figures for the Terai below Darjeeling, I give these as I imagine. The two rain-falls must be very similar.

I will now endeavour to draw up a tabular statement of the respective advantages of the various Tea districts as regards climate, labour, soil, facilities of procuring manure, and transport.

In importance I regard them in the order given. I place labour before soil, because the fact is in all the provinces suitable and good soil for tea can be found *somewhere;* and therefore while soil is all important in selecting a site, it is secondary to labour in deciding on a district. When my information on any point is not sure I place a note of interrogation. Where advantages are equal, or nearly so, I give the same number, and the greater the advantage of a district, on the point treated in the column, the smaller the number. Thus under the head of climate, Assam is marked 1, meaning it is the best.

As the following table gives no information, as to which of all the districts possesses the greatest advantages, *all things considered;* but only gives my opinion of each under each head, and the subject closed in this way would be unsatisfactory, I may state that, either Chittagong, or the Terai below Darjeeling, are the places which I think will eventually pay best. But were local labour obtainable in either Assam or Cachar, they would rank first.

Comparative advantages of the Tea Districts in India as regards climate, labour, soil, manure, and transport.

Tea Districts.	Climate.	Labour.	Soil.	Manure.	Transport.	
Assam	1	5	1	4	3	Water carriage.
Cachar	2	4	2	4	2	
Chittagong	3	2	3	1	1	
Chittagong Hill Tracts	2	3	1	2	1	
Terai below Darjeeling	3	3	1	3?	5	Land carriage.
Darjeeling	4	3	2	3?	6	
Hazareebaugh...	4	1	3	2	4	
Kangra	4	3	3	3?	9	
Dehra Dhoon	5	3	4	3?	7	
Kumaon	6	2	1	3	8	
Nilgherries	6	...	3	...	4	

In some parts of the Chittagong Hill Tracts no manure or labour could be procured, while in others they would be moderately plentiful. I have assigned its value under those two heads, on the supposition favourable sites for manure and labour would be selected, but such sites are very few.

CHAPTER IV.

Soil.

To pronounce, as precisely, on soil as on climate is not easy. The tea plant will grow on almost any soil, and will flourish on many. Still there are broad general rules to be laid down in this selection of soils for tea, which no one can ignore with impunity.

When first I turned my attention to tea, I collected soils from many gardens, noting in each case how the plants flourished. I then set down to examine them, never doubting to arrive at some broad practical conclusions. I was sadly disappointed. I found the most opposing soils nourished, apparently, equally good plants. I knew not then much about tea, and judged of the tea bushes mostly by their size; (a very fallacious test) still after-experience has convinced me, I was more or less right in the conclusion I then came to, that several soils are good for tea.

Nothing then but broad general rules can be laid down on this point, for I defy any one to select any one soil, as the best for tea, to the exclusion of others.

A light sandy loam is perhaps as good a soil, as any, out of the Himalayas. It ought to be deep, and the more decayed vegetable matter there is lying on its surface the better. If deep enough for the descent of the tap-root, say three feet, it matters not much what the sub-soil is, otherwise a yellowish red sub-soil is an advantage. This sub-soil is generally a mixture of clay and sand. Much of Assam, Cachar, and Chittagong is as the above, but as a rule it is richest in Assam, poorest in Chittagong.

Where the loam is of a greasy nature, (very different to clay) with a mixture of sand in it, it is superior to the above for it has more body. All good tea soils must have a fair proportion of sand, and if not otherwise apparent, it may be detected by mixing a little of the soil with spittle, and rubbing it on the hand. If the hand is then held up towards

the sun, the particles of sand will be seen to glisten.

The soil so common in the Himalayas, that is light rich loam with any amount of decayed vegetable matter on it and with a ferruginous reddish yellowish sub-soil, is, I consider, the finest soil in the world for tea. What a pity it nowhere exists in a really good tea climate. The rich decayed vegetable matter is the produce for centuries of the oak leaves in the Himalayan forests, and as all the world knows oak only grows in temperate climes.

It was long believed that tea would thrive best on poor soil. The idea was due to the description of tea soils in China, to be found in the first books that treated of tea. But the fact that tea, as a rule, is only grown in China on soil which is useless for anything else, quite alters the case. If a soil is light and friable enough, it cannot be too rich for tea.

Ball's book "on the cultivation and manufacture of tea in China" has much on tea soils, but the opinions the author collected are sadly at variance, and on the whole teach nothing.

In conclusion, I will attempt to point out the qualities in soils in which the tea plant delights, as also the qualities it abhors.

It loves soils friable, that is easily divided into all their atoms. This argues a fair proportion of sand, but this should not be in excess, or the soil will be poor. The soil should be porous, imbibing and parting with water freely. The more decayed vegetable matter on its surface, the better.

To be avoided are stiff soils of every kind, as also those which when they dry, after rain, cake together and split. Avoid also black coloured, or even dark coloured earths. All soils, good for the tea plant, are light coloured. If, however, the dark colour arises from decayed vegetation, that is not the colour of the soil, and as observed, vegetable matter is a great advantage. Judge of colour when soil is dry—for even light coloured soil looks dark when wet. Soil which will make

bricks, will not grow tea, and though I have sometimes seen young plants thrive on stiff soil, I do not believe in any stiff soil as a permanence.

Stones, if not in excess, are advantageous in all soils inclined to be stiff, for they help to keep them open. But then they must not be large, as if so they act as badly as a rocky substratum preventing the descent of the tap-root.

The reason, I take it, why tea thrives best in light soils is that the spongioles, or ends of the feeding roots, are very tender, and do not easily penetrate any other.

There is more nourishment in stiffer soils, but for this reason the tea plant cannot take advantage of it.

If a chosen soil is too stiff, it may be much improved for tea by mixing sand with it. However, even where sand is procurable near, the expense of this is great. When done, the sand should be mixed with the soil taken out of the holes in which the plants are to be placed, (see transplanting) and it may be done, again later, by placing sand round the plants and digging it in. All this though is extra labour and very expensive, so none but a good tea soil should ever be selected, and it is very easily found, for it exists in parts of all the districts discussed.

CHAPTER V.

Nature of Jungle.

I HAVE not much to say under this head. I have heard many opinions as to the kind of trees and jungle, that should exist in contemplated clearances, but I attach little or no weight to them, at all events in Bengal.

In the Himalayas it is somewhat different. There oak trees should be sought for, their existence invariably makes rich soil.* Fir on the contrary, indicates poor soil. At elevations, however, the desideratum of a warm aspect interferes, for the best oak forests are on the colder side. I speak of course of

* The oak tree leaves cause a rich deposit of vegetable matter.

elevations practicable, say three or four thousand feet, above this it is a waste of money to try and cultivate tea.

In Bengal, I do not think the nature of the jungle on land contemplated, signifies much. As a rule the thicker the jungle, the richer the soil; but if seeking for a site, large trees should not be a *sine qua non*. Much of the coarse grass land is very good, and large trees add enormously to the expense of clearings. It is not cutting them down, which is so expensive, it is cutting them up and getting rid of them by burning or otherwise, after the former is done.

I have discussed soil fully already and need only add here, that if the knowledge to do so exists, it is better to judge of soil from the soil itself, than from the vegetation on it, though doubtless a fact, that luxuriant vegetation indicates rich soil.

CHAPTER VI.

Water and Sanitation.

These may be discussed together, and shortly.

Of course adjacent water carriage is a great advantage for a garden, and it should be obtained, if possible, in selecting a site. The expense of land carriage, tea being such a bulky article, is great, and tea cultivation requires all advantages to make it pay well.

But it is water for a garden that particularly concerns us now. It is not easy to find land that can be irrigated (this is discussed elsewhere) but no labour or expense in getting such land would be thrown away. Irrigation, combined with high cultivation in other respects, will give a yield per acre undreamt of.

In no case should a plantation be made except where a running stream is handy. Water is a necessity for seedlings and a plentiful adjacent supply of it is a great desideratum for the comfort and health of every soul on the garden. We all know how dependent the natives are on water, and it is evident facilities in this respect will conduce much (whether the

labour be local or imported) both to get, and keep coolies.

It has been observed that as a rule, good tea climate is not a healthy one. There is no getting over the fact and we can only make the best of it. The house, the factories and all the buildings should be placed as high as possible, and not very close to each other, both for the sake of health and in the event of fire. The locality should be well drained, and cleanliness be attained in every possible way. Give the coolies good houses, with raised mechans to sleep on, and sprinkle occasionally carbolic acid powder in your own house, and those of others.

Sanitation is however a large subject. It can be studied elsewhere. General ideas on it and on the properties of the commonest medicines are a great advantage to any intending tea planter.

CHAPTER VII.

Lay of Land.

THE first idea prevailing about tea was that it should be planted on slopes. It was thought, and truly, that the plant was impatient of stagnant water, and so it is, but it is not necessary to plant it on slopes in consequence. Pictures of Chinese, suspended by chains, (inasmuch as the locality could not be otherwise reached) picking tea off bushes growing in the crevices of rocks somewhat helped this notion; and when stated, as it was, that the tea produced in such places was the finest and commanded the highest price, intending planters in India went crazy in their search, for impracticable steeps! Much of the failure in tea has arisen from this fact, for a great part of many, the whole of some gardens, has been planted on land, so steep, that the tea can never last or thrive on it.

Sloping land is objectionable in the following respects. It cannot be highly cultivated in any way, (I hold tea will only pay with high cultivation) for high cultivation consists in fre-

quent digging, to keep the soil open, and get rid of weeds and liberal manuring. If such soil is dug in the rainy season it is washed down to the foot of the hill, and if manure is applied at any time of the year, it experiences the same fate when the rains come. As it cannot be dug, weeds necessarily thrive and diminish the yield by choking the plants.

The choice is therefore of two evils "low cultivation and weeds" or "high cultivation which bares the roots of the plants in a twelve month." Of the two, the first *must* be chosen, for if the latter were pursued the plants getting gradually more and more denuded of soil, would simply topple over in two or three years. But choosing the lesser evil, the mischief is not confined to the bad effects of low cultivation. Dig the land as little as you will, the great force of the rains washes down a good deal of soil. The plants do not sink, as the soil lowers, and the consequence is that all tea plants on slopes have the lower side bare of earth, and the roots exposed. This is more and more the case the steeper the slope. These exposed roots shrivel up, as the sun acts on them, the plant languishes, and yields very little leaf.

Attempts are made to remedy the mischief by carrying earth up from below yearly, and placing it under the plant, but the expense of doing this is great, and the palliation is only temporary, for the same thing occurs again and again, as each rainy season returns.

The mischief is greater on stiff, than on sandy soils, for on the former the earth is detached in great pieces and carried down the hill. I know one garden in Chittagong, a large one, where the evil is so great, that the sooner the cultivation is abandoned, the better for the owners.

A great many gardens in India, indeed the majority, are on slopes. A few in Assam, the greater number in Cachar, some in Chittagong, and almost all the Himalayan plantations. Such of these as are on *steep* slopes will I believe never pay, and instead of improving yearly (as good gardens,

highly cultivated, should do even after they have arrived at full bearing) such, I fear, will deteriorate year by year.

Plantations on moderate slopes, need not fail, because of the slopes. The evils slight slopes entail are not great, but the sooner the fact is accepted that sloping cannot vie against flat land for the cultivation of tea, the better.

Where only the lower part of slopes are planted, the plants do very well. The upper part being jungle the wash is not great, and the plants benefit much by the rich vegetable matter the rain brings down from above. I have often seen very fine plants on the lower part of slopes, where the upper has been left in jungle, and I should not hesitate to plant such portions *if* the slope was moderate.

Where teelah land, in Eastern Bengal, or sloping land in the Himalayas, Chittagong, or elsewhere, has to be adopted, aspect is all important. A good aspect in one climate is bad in another. In Assam, Cachar, Chittagong, and all warm places, choose the coolest, at high elevations (temperate climes) the warmest.

In the Himalayas, moreover, the warmer aspects are, as a rule, the most fertile; *vice versa* in warm localities. Many a garden, which would have done very well, on the moderate slopes chosen, had *only* the proper aspects been planted, has been ruined by planting all sides of teelahs or hills indescriminately. The southern and western slopes of plantations in warm sites, are generally very bare of plants. Not strange they should be so, when the power of the reflected rays of the afternoon sun are considered. Again, in cold climates plants cannot thrive on northern aspects, for their great want in such climes is heat and sunshine. Let the above fault, then be avoided in both cases, for though, doubtless, a garden is more handy, and looks better in one piece planted all over without introducing jungle, even patches of jungle look better, and are decidedly cheaper, than bare cultivated hills.

Of flat land, after what I have written, I need not add much.

It is of two kinds, table and valley land; the former is very rare in tea districts, at least of any extent, which makes it worth while to plant it. There are two gardens in Chittagong on such flat table land, and they are both doing very well. Table land cannot be too flat, for the natural drainage is so great, no stagnant water can lie. It is inferior to valley land in the dry season, but superior in the rains.

Valley land is not good if it is perfectly flat. It will then be subject to the inundation and stagnant water. There is nothing that kills the plant so surely and quickly as the latter. Even quite flat valleys, can be made sweet, by artificial drainage, but to do this, lower level, not too far distant, must exist, and the danger is not quite removed then. Valleys, in which no water course exists, and which slopes towards the mouth *alone*, are to be avoided, for the plants near the mouth always get choked with sand. The best valleys are those with a gentle slope both ways, one towards the lowest line of the valley, be it a running water-course, or a dry nullah which carries off rain, the other, which should be the highest slope, towards the mouth of the valley. Such valleys drain themselves, or at least very little artificial drainage is necessary. A valley of this kind, with a running stream through it, is *most* valuable for tea, and if the other advantages of soil and climate are present it is simply a perfect site. Such however are not frequent. If in such valleys, as is generally the case, the slope from the head to the mouth is enough, the running streams can be "bounded" (shut up) at a high level, and brought along one side at a sufficient elevation to irrigate the whole.

I have never seen but one garden in a valley that fulfils all these conditions exactly. It is in Chittagong, the soil is good, labour plentiful, and manure abundant. It ought to do great things, for the possibility of irrigating plants in the dry season (which as observed is very trying in Chittagong) will give several extra flushes in the year.

Of course in the wet season on such land, the water must be allowed to resume its natural course.

Narrow valleys are not worth planting, if the hills on the sides are steep and consequently better left in jungle. No narrow tracts of land, with jungle on both sides, are worth the expenses of cultivation, for the continual encroachment of the jungle gives much extra work. The plants, moreover, in very narrow valleys, get half buried with soil, washed down from the adjacent slopes. Narrow valleys are therefore, in any case, better avoided.

To conclude, shortly, flat lands can be highly cultivated, steep slopes cannot. Tea pays best (perhaps not at all otherwise) with high cultivation, *ergo* flat lands are preferable.

CHAPTER VIII,

Laying out a Garden.

By this I mean, so dividing it when first made into parts, that later the said parts shall be easily recognized, and separately or differently treated, as they may require it.

The usual custom is to begin at one end of a plantation, and dig it right through to the other. In the same way with the pruning and plucking, and I believe the system is a very bad one. Different portions of gardens require different treatment, inasmuch as they differ in soil, and otherwise. One part of a plantation is much more prolific of weeds than another—how absurd that it should be cleaned no oftener! This is only one exemplification of difference of treatment, but in many ways it is necessary, most of all in plucking leaf.

All parts of a plantation, owing in some places to the different ages of the plants, in others to the variety in the soil and its productive powers, or in others where slopes exist to the aspect, do not yield leaf equally, that is flush does not follow flush with equal rapidity. In some places, (supposing each part to be picked when the flush is ready) seven days interval will exist between the flushes, in others nine, ten, or

twelve, but no attention as a rule is paid to this. The pickers have finished the garden at the west end, the east end is again ready, and when done, the middle part will be taken in hand, be it ready, or be it not! It may be said the middle part flushes quicker than any other, in this case the flush will be more than mature, when it is taken, in fact it will have begun to harden. Or it may be the middle part does not flush as quickly as the others, in this case it will be picked before it is ready, that is when the flush is too young, and the yield will consequently be smaller.

I believe the yield of a plantation may be largely increased by attending to this. Every tea estate should be divided into gardens, of say about six to ten acres each. If no natural division exists, roads to act as such should be made. More than this cannot be done when the plantation is first laid out, but when later the plants yield, any difference between the productive powers of different parts of the same garden, should be noted and these divided off into sections. To do this with roads would take up too much space, and small mansonry pillars, white-washed, are the best. Two of these, one at either end of any side of a section, are enough, and they need not be more than three feet high, and a foot square. Thus each garden may be divided into three or four sections, which in a hundred acre estate, partitioned off into ten gardens, would give about 30 or 40 sections. No matter where a section may be, directly the flush on it is ready it should be picked. Where the soil on any one garden is much the same, and observation shows the plants all over it flush equally, it may be divided into only two sections, or even left all in one. I only lay down the principles, and I am very certain it works well, the proof of which is, that where I have practised it, some sections during the season give three, four, and five flushes more than others. Had the usual plan of picking, from one end to the other, been adopted, they would have been all *forced* to give the same number. In other

words the said extra flushes would have been lost, and further loss occasioned by some flushes being taken before they were ready, others after a portion of the tender leaf had hardened.

The best plan is simply to number the gardens from one upwards, and the sections in each garden the same way. Thus supposing No. 5 garden is divided into three sections, they will be known respectively as 5-1, 5-2, and 5-3. This is the best way for the natives, and I find they soon learn to designate each section. I have a man whose special duty (though he has other work also) it is to see each day which sections are ready to pick the following, and those, and those alone, are picked. Practice soon teaches the number of pickers required for any given number of sections, and that number only are put to the work. If a portion is not completed that day, it is the first taken in hand the next, and if any day on no sections is the flush ready, no leaf is picked the following.

Apart from leaf-picking, the garden and section plan detailed is useful in many ways. Each garden, if not each section which most requires it, is dug, pruned, or manured at the last time, and any spot on the plantation is easily designated. The plan facilitates the measurement of work and enables correct lists of the flushes gathered to be kept. It is thus seen which gardens yield best, and the worst can by extra manuring, be brought to equal those.

In short the advantages are many, too numerous to detail.

Of course all this can be better done on a flat garden, than on one planted on slopes, and though it may not be possible to work it out as much in detail on the latter, still a good deal in that way can be done, and I strongly recommend it.

In laying out a plantation, keep it all as much together as possible, the more it is in one block, the easier it is supervised, the cheaper it is worked. Still do not, with a view to this, take in any bad land, for bad land will never pay.

Let your lines of tea plants, as far as practicable, run with geometrical regularity. You will later find both in mea-

suring work, and picking leaf, great advantages therefrom. In gardens where the lines are not regular, portions are continually being passed over in leaf-picking and thereby not only is the present flush from such parts lost, but the following is also retarded.

If your different gardens are so situated, that the roads through them, that is from one garden to the other, can be along *the side* of any garden without increasing the length of the road, by all means adopt that route. There is no such good boundary for a garden as a road that is being continually traversed. It will save many rupees by preventing the encroachment of jungle into a garden, and more space is thus also given for plants. It is, however, of no use to do it if a road through the middle of the garden is shorter, as coolies *will* always take the shortest route.

The lines of plants, on sloping ground, should neither run up and down, nor directly across the slope. If they run up and down, gutters or water-courses will form between the lines, and much additional earth will be washed away thereby. If they run right across the hill, the same thing will occur, *between the trees in each line,* and the lower side of each plant will have its roots laid very bare. It is on all slopes a choice of evils, but if the lines are laid diagonally across the hill, so that the slope *along the lines* shall be a moderate one, the evil is reduced as far as it can be, by any arrangement of the plants. No, I forgot, there is one other thing. The closer the lines to each other, and the closer the plants in the lines to each other, in short the more thickly the ground on slopes is planted, the less will be the wash, for stems and roots retain the soil in its place, and the more there are, the greater the advantage.

Where slopes are steep and where there are stones (though remember steep slopes are to be avoided) terracing may be resorted to with advantage as the washing down of the soil is much checked by it. Without stones, and large ones to

support them, no terraces will hold, and their construction is a loss.

On flat land of course, it does not really signify in which directions the lines run, but such a garden looks best if, when the roads are straight, the lines run parallel to them.

In laying out a garden, choose a central spot with water handy for your factory, bungalow, and all your buildings; let your tea houses be as close to your dwelling-house as possible, so that during the manufacturing time, you can be in and out at all hours of the day and night. Much of your success will depend upon this. Let all your buildings be as near to each other as they can, but still far enough apart, that any one building may burn, without endangering others. You need not construct any tea building until the third year.

CHAPTER IX.

Varieties of the Tea Plant.

These are many, but they all arise from two species, the China plant, the common tea bush in China, and the indigenous plant, first discovered some forty years ago in Assam.

These are quite different species of the same plant. Whether the difference was produced by climate, by soil, or in what way, no one knows, and here we have only to do with the facts that they do differ in every respect. A purely indigenous plant or tree (for in its wild state it may more properly be called the latter) grows with one stem or trunk and runs up to 15 and 18 feet high. It is always found in thick jungle and would thus appear to like shade. I believe it does, when young; but I am quite sure if the jungle were cleared round an indigenous tea tree found in the forest, it would thrive better from that day. The China bush (for it is never more) after the second year, has numerous stems, and six or seven feet would seem to be its limit in height. The lowest branches of a China plant are close to the ground, but in a pure cultivated indigenous, nine inches to a foot above the soil, up to which

the single stem is clean.

The indigenous grows quicker after the second or third year than the China if it has not been over-pruned or over-plucked when young. In other words it flushes quicker, for flushing is growing.

The indigenous does not run so much to wood as the China. Indigenous seedlings require to be watered oftener than China, for the latter do not suffer as quickly from drought. The indigenous tree has a leaf of nine inches long and more : the leaf of the China bush never exceeds four inches. The indigenous leaf is a bright pale green, the China leaf a dull dark green colour. The indigenous "flushes," that is produces new tender leaf much more copiously than China, and this in two ways, first the leaves are larger, and thus, if only even in number, exceed in bulk what the China has given, and *secondly*, it flushes oftener. The infusion of tea made from the indigenous species, is far more "rasping" and "pungent" than what the China plant can give, and the tea commands a much higher price. It is difficult to prune the China plants too young, the indigenous on the contrary requires tender treatment in this respect. The young leaves from which alone tea is made are of a much finer and softer texture in the indigenous than in the China, the former may be compared to satin, the latter to leather. The young leaves of the indigenous moreover do not harden so quickly as those of the China, thus if there is any unavoidable delay in picking a flush, the loss is less with the former. In the fact, that unpruned or unpicked plants (for picking is a miniature pruning) give fewer and less succulent young leaves which harden quicker than pruned ones, the two varieties would seem to be alike. The China variety is much more prolific of seed than the indigenous, the former also gives it when younger, and as seed checks leaf, the China is inferior in this as in other respects. The China is by far the hardier plant. It is much easier to rear and it will grow in widely differing climates which the indigenous will not.

A patch of indigenous with a mature flush on it is a pretty sight. The plants all appear as if crowned with gold (they are truly so if other advantages exist) and are a great contrast to the China variety if it can also be seen near.

I have now, I think, pointed out the leading characteristics of the two original varieties of the tea plant, and it stands to reason no one would grow the China who could get indigenous. But the truth is a pure specimen of either is rare. The plants between indigenous and China are called "hybrids." They were in the first instance produced by the inoculation, when close together, of the pollen of one kind into the flower of the other, and the result was a true hybrid, partaking equally of the indigenous and China characteristics; but the process was repeated again and again, between the said hybrid and an indigenous, or China, and again later between hybrids of different degrees, so that now there are very many varieties of the tea plant, 100 or even more, and no garden is wholly indigenous or wholly China. So close do the varieties run, no one can draw the line and say where the China becomes a hybrid, the hybrid an indigenous. Though as a rule the young leaves are light green, or dark green, as the plant approaches the indigenous or China in its character, there are a certain class of bushes (all hybrid) whose young leaves have strong shades of crimson and purple. Some even are quite red, others quite purple. These colours do not last as the leaf hardens, and the matured leaves of these plants do not differ from others. Plants with these coloured leaves are prolific.

The nearer each plant approaches the indigenous the higher its class and excellence, *ergo* one plantation is composed of a much better class of plants than another. Had China seed never been introduced into India, a very different state of things would have existed now. The cultivation would not have been so large but far more valuable. The propagation and rearing of the indigenous as observed is difficult, the China is much hardier while young. So difficult is

it to rear successively the *pure* indigenous, perhaps the best plan, were it all to come over again, would be to propagate a high class hybrid and distribute it, never allowing any China seed or plants to leave the nursery, which should have been a Government one. But we must take things as they are. The Government nurseries in the Himalayas and the Dehra Dhoon, (there have never been any elsewhere and worse sites could not have been chosen) were planted entirely with China seed, the seedlings distributed all over the country, and thus the mischief was done. The Indian tea is vastly superior to China, and commands a much higher price at home, but it is still very inferior to what it would have been, had not China seed been so recklessly imported and distributed over the country.

The home of the indigenous tea tree is in the deep luxurious jungles of Assam and Cachar.* There it grows into a good sized tree. I have seen it 20 feet high. These are of no use, except for seed, until they are cut down. When this is done they throw out many new shoots, covered with young tender leaves, fit for tea. They are of course far too big to transplant, but on some sites where they were numerous, that spot was chosen for the plantation, and some of these are the best gardens in Assam and Cachar.

The indigenous plant and high class hybrid requires a hot, moist climate, and will not therefore flourish in any parts of India outside Eastern Bengal. I have tried it in the Himalayas, there the cold kills it. In Dehra Dhoon and Kangra the climate is far too dry; besides the hot winds in the former, and the cold in the latter, are prejudicial. The Terai under Darjeeling would, I think, suit it, but I have never been there and cannot speak from experience. The Neilgherries (for the reasons given in another Chapter) will not, I believe, answer

* It is a singular fact that none exist in Northern Cachar that is on the Northern side of the river.

for tea at all. In Assam, Cachar, and Chittagong, the indigenous and the highest class hybrids will thrive, for the climate of all three suit it, but perhaps Northern Assam possesses the best climate of all, for that description of plant.

The Himalayan gardens consist entirely of China plants mixed occasionally with a low class of hybrid. They were all formed from the Government Nurseries where nothing but China was reared. Occasional importations of Assam and Cachar seed will account for the sprinkling of low class hybrids which may be found. The same may be said of Dehra Dhoon and Kangra. In some gardens on the Terai below Darjeeling, I believe a high class of plant exists. In Assam, Cachar, and Chittagong, the plantations vary much, but all have some indigenous and high class hybrids, while many gardens are composed of nothing else.

It is evident then that the value of a garden depends much on the class of its plants, and that a wise man will only propagate the best. Only the seed from good varieties should be selected, and gradually all inferior bushes should be rooted out and a good kind substituted. When this shall have been systematically done for a few years, on a good garden, which has other advantages, the yield per acre will far exceed any thing yet realised or even thought of.

Government action in the matter of tea has been prejudicial in many ways, but in none more so than when they were doing their best to foster the cultivation by distributing China seed and seedlings gratis. No one can blame here (would the Government were equally free from blame in all tea matters) but the mischief is none the less. It will take years to undo the harm then done.

The seed of indigenous, hybrid, and China are like in appearance and cannot be distinguished. Thus, when seed formerly was got from a distance, the purchaser was at the mercy of the vendor.

High cultivation improves the class of a tea-plant. Thus a

purely China bush, if highly cultivated and well manured, will in two or three years assume a hybrid character. High cultivation will therefore improve the class of *all* the plants in a garden ; but the cheapest and best plan with low class China plants, is to root them out and replace them with others, as will be explained hereafter. Low class seedlings should also be rooted out of nurseries.

I cannot conclude this Chapter better than by giving an extract from the " Government Records" alluded to, and I add a few remarks at foot, as otherwise the reader might be puzzled with some opinions expressed, so much at variance with the generally received opinions on tea to-day.

Kinds of Tea Plants cultivated.—" When Government resolved on trying the experiment of cultivating Tea in India, they deputed Doctor Gordon to China to acquire information respecting the cultivation and manufacture of Teas, and to procure Tea seeds. Aided by Doctor Gutzlaff he procured a quantity of seeds from the mountains in the Amoy Districts. These seeds were sent to the Calcutta Botanical Garden, where they were sown in boxes. On germinating they were sent up the country in boats, some to Assam and some to Gurhmuktesur, and from thence to Kumaon and Gurhwal. From these plants date the commencement of the Tea Plantations in the Himalayas.* Tea was first made in Kumaon in 1841, and the samples sent to England, and were pronounced to be of good quality fitted for the home markets and similar to the Oolong Souchong varieties. Thus Messrs. Thompson, of Mincing lane, report on a sample sent by us to Doctor Royle in 1842 :—" The sample of Tea received belongs to the Oolong Souchong kind, fine flavoured and strong. This is equal to the superior black Tea generally sent as presents, and better for the most part than the China Tea imported for mercantile purposes."† By many it was supposed that there were different species of the Tea plant, and that the species cultivated in the South Districts of China was different from that met with in the North. To

* And also the introduction of a bad class of plants.

† A single small sample of tea very carefully made, and with an amount of labour which could never be bestowed on the mass, is little or no criterion. Tea is better made in Kumaon in 1870 than it was in 1842, but Kumaon tea does not vie in price with Eastern Bengal produce. All the Himalayan tea is weak, though of a delicate flavour ; all tea grown at high elevations must be so.

solve this mystery, and at the same time procure the best varieties of the Tea plant, Mr. Fortune was deputed to China. By him large numbers of Tea plants were sent from different Districts of China celebrated for their Teas, and are now thriving luxuriantly in all the Plantations throughout the Kohistan of the North-West Provinces and Punjab. Both green and black Tea plants were sent, the former from Whey Chow, Mooyeen, Chusan, Silver Island, and Tein Tang, near Ningpo, and the latter from Woo-e San, Tein San and Tsin Gan, in the Woo-e District. But so similar are the green and black Tea plants to each other, and the plants from the Amoy Districts, that the most practised eye, when they are mixed together, cannot separate them, showing that they are nothing more than mere varieties of one and the same plant, the changes in the form of the leaf being brought about by cultivation. Moreover, throughout the plantation fifty varieties might easily be pointed out; but they run so into each other as to render it impossible to assign them any trivial character; and the produce of the seed of different varieties do not produce the same variety only, but several varieties, proving that the changes are entirely owing to cultivation, nor do the plants cultivated at 6,000 feet in the Himalayas differ in the least in their varieties from those cultivated at 2,500 feet of altitude in the Deyrah Dhoon.

Several varieties.

"That the Assam plant is a marked species is true, it being distinguished by its large membraneous and lanceolate leaf, small flower, and upright growth.

Assam species.

"It is a very inferior plant for making Tea, and its leaves are therefore not used.* Though the plants received from the different Districts of China do not differ from those first sent to the Plantations, it is highly important to know that the Tea plants from well-known green and black Tea Districts of China now exist in the Plantations, as it is stated that local causes exert a great influence in the quality of the Teas, as much as the manufacture does. The expense, therefore, incurred in stocking the Government Plantations with the finest kinds and varieties of Tea plants procurable in China, though great, will be amply repaid. From them superior kind of Teas are produced. This, however, I doubt, as the Teas prepared from the first imported plants have reached a perfection not surpassed by any Chinese produce."†

* A little enquiry would have shown this was not true, even when it was written. All tea planters, brokers, and all interested in tea know now (many knew it then) that the "Assam species," *viz.*, the indigenous, makes the most valuable tea produced.

† There must be some misprint here for the last sentence in connection with the preceding one is unintelligible.

The above extract is a sample of the said "Records." They abound in errors and highly coloured statements, which induced many to embark in Tea on unfavourable sites, and "the red book" (it is bound in red cover) is not exactly blessed by the majority of the Himalayan planters.

CHAPTER X.

Tea Seed.

THOUGH there is a great difference in tea plants (see last chapter) the seed of all is the same, and it is therefore impossible to say from what class of plants it has been gathered.

When tea seed was very valuable (it has sold in the tea-fever days as high as Rs. 200 per maund) it was the object of planters to grow as much as possible, but now that its value is nominal, and as seed on the tea bush checks leaf, planters should prevent as far as they can their trees from bearing it.

High class plants do not give much seed, a plantation therefore with much on it, should be avoided in purchasing seed.

The tea flower (the germ of next year's seed) appears in the autumn and the seed is ripe at the end of the following October or early November.

It takes thus one year to form.

Seed is ripe when the capsule becomes brown, and when breaking the latter, the inner brown covering of the seed adheres to the seed and not to the capsule.

One capsule contains 1, 2, 3, and sometimes even 4 seeds.

Though the mass ripens end of October, some ripen earlier; the capsule splits and the seed falls on the ground. If, therefore, all the seed from a garden is required, it is well to send round boys all October to pick up such seeds.

When the seed is picked end of October or early November, the mass are still in capsules. It should be laid in the sun for one hour daily for two or three days until most of the capsules have split. It is then shelled, and the clean seed

laid on the floor of any building where it will remain dry. Sunning it *after* shelling it is objectionable.

The sooner it is sown after it is shelled the better.

If for any reason it is necessary to keep it say a fortnight or three weeks before sowing, it is best kept *towards* germinating, in layers covered with dry mould. But if to be kept longer, leave it on the dry floor as above, taking care it is thinly spread (not more than one seed thick if you have space) and collected together, and re-spread every day to turn it.

For transport to a distance it should be placed in coarse gunny bags only one-third filled. If these are shaken and turned daily during transit, a journey of a month will not very materially injure the seed.

For any *very* long journey it is best placed in layers in boxes with thoroughly dry and fine charcoal between the layers, and sheets of paper here and there to prevent the charcoal running to the bottom.

It is scarcely necessary to consider how tea seed can be utilized when not suitable, for as stated, seed prevents leaf, and therefore it will not be grown if there is no market for it. It will, however, make oil, but the price it would fetch for this purpose would not compensate for the diminished yield of leaf it had caused. It is also valuable as manure mixed with cattle-dung, but it would not pay to grow it for this purpose either.

My advice therefore is to allow no more seed on the garden than you require for your own use, (even the fullest gardens require some yearly) or then you can sell at a reasonable price. I call the latter Rs. 20 per maund. It will not pay to grow it for less.

If the object is to produce a considerable quantity of seed, set apart a piece of the plantation for it, and do not prune it at all. A large number will then be produced on that piece; you may also pick what leaf it gives the following season, but you will get very little.

If the object is to grow as little seed as possible, after the pruning in the cold-weather which destroys the greater part, send round boys to pick off such of the germs as remain.

If this is done, ever so carefully, some will escape, enough say to give one maund seed from 10 acres of garden, and this as a rule is enough for nurseries to fill up vacancies.

The following figures regarding seed will be found useful—

Seven maunds seed, with capsules, give 4 mds. clean seed.

One maund clean seed,		(fresh)	= 26,000 seeds.
"	"	(ten days old)	= 32,000 "
"	"	(one month old)	= 35,030 "

Say therefore, in round numbers, that one maund tea seed = 30,000 seeds.

With good tea seed, sown shortly after it is picked, 20,000 will germinate.

If you get 10,000 to germinate with seed that has come a long distance, you are lucky.

After a two months' journey more than 5,000 at the best cannot be looked for.

CHAPTER XI.

Comparison between sowing in Nurseries and in Situ.

In the one case, the seed is placed in Nurseries at the close of the year, and the young plants transplanted into the garden at beginning of the following rains.

In the other, the seed is (at the same time, *viz.*, close of the year) sown at once in the plantation, where the plants are intended to grow.

Each of these plans has its advocates, who don't believe in the other plan at all! The question is which is the better?

Their respective advantages may be shortly summed up as follows:—

Nurseries.

Advantages.—The seed may be made to germinate early by watering. After it germinates, the plants can be watered

from time to time, as they require it. Artificial shade (a great help to the germination of tea seed) can be given. The soil can be frequently opened and the plants in every way better tended in nurseries.

Disadvantages.—The plants lose at least three months growth when transplanted, and may die. The transplanting necessitates labour, at a time of the year it is much wanted for other work. The expense is greater than the other plan, for there are the nurseries to make, and the labour of transplanting.

In Situ.

Advantages.—The plants gain some three months in growth by not being moved. It saves labour at the busy time, *viz.*, early in the rains. It saves all the labour of transplanting, that is it *saves* labour absolutely, and *gives* labour when, as stated, it is much required.

Disadvantages.—If the early rains (that is rain in December, January, and February) fail, but few seeds germinate. In the case of a new garden the soil must be kept clean six or seven months before it would be necessary by the nursery plan. No artificial shade can be given.

It will thus be seen, that the advocates of both plans have much to urge in their respective favours. Which is better?

The advocates of each plan are guided by the climate they have planted tea in, and the truth is simply that the better plan for one place is not adapted to another. Planting in situ where it will succeed is the cheaper, and better, and it will do so wherever there are certainly cold-weather and spring rains. Thus (see rain table) it will succeed in Upper Assam, Cachar, and perhaps the Terai below Darjeeling. It will fail in Chittagong, Lower Assam, and Hazareebaugh. In Chittagong, for instance, a garden could never be made by planting in situ or as it is generally called at stake. In no Himalayan garden, either, would it, I believe, succeed.

In this, and other matters, adopt your operations to the existing climate.

Where seed is planted at stake, it is well not to rely entirely on it. Make a nursery also, many plants may be killed by crickets, and the vacancies can then be filled up. Again the early rain *may* fail, and thus a whole year's labour would be thrown away.

I will now describe the above two methods of sowing seed.

CHAPTER XII.

Sowing seed in Situ, id est at stake.

It is named "at stake," because stakes are put along in lines to show where the tea trees are to be, and the seed is sown at those spots.

The *modus operandi* is very simple. A month before the sowing time, at each stake, dig a hole at least 9 inches diameter and 12 inches deep, put the soil taken out on the sides, taking care, however, if it be on a slope, to put none above the hole. Do not put the soil near enough to the pit, to make it likely it will be washed back. Such soil as should be washed in, ought to be the new rich surface soil. For this reason the upper side of the hole should be left free on slopes. The pits are made a month before-hand to admit of this, and to allow the action of the air on the open side, to improve the mould.

If lucky enough to have one or two falls of rain in the month, the holes will be more or less filled up with soil, eminently calculated to instigate rapid growth. Just before sowing, fill up the pit with surrounding surface soil. Whether to mix a little manure with it or not, is a question. If it is virgin soil and rich in decayed vegetation, I say no. If not virgin soil and rather poor, yes; but it must be strictly in moderation, not more say than a man can hold in both hands, to each hole. In filling up the hole, press the soil down lightly two or three times, or it will all sink later and your

seeds be far too deep.

When the above is all done there is a perfect spot for the reception of the seed. The tap-root can readily descend in search of moisture, and the lateral rootlets can spread likewise. They, the latter, will not reach the outer walls of the pit for a twelvemonth; and will then be strong enough to force their way through.

Now sow the seed, put in say three in a triangle, three or four inches apart. Push them into the soft soil one inch, and put up the stake in the centre to mark the spot.

Keep the place clean till following rains, but allow only hand-weeding near the young seedlings, and occasionally open the soil with some light-hand instrument as "a koorpee" to the depth of half an inch.

If all three seeds germinate and the seedlings escape crickets and all live, at commencement of the rains leave the best and transplant the two others to any vacant spot. You will succeed with some, not with others; but do not be anxious to take up the two with earth round the roots, and thus endanger the plant left. That the seedling left, be not injured, is the great point, the other two must take their chance.

Some people believe in two or even three seedlings together, and would thus advise them to be all, or perhaps two left. I do not approve the plan. Plant as close, as you will, in the lines, but give each plant its own home.

CHAPTER XIII.

Nurseries.

CHOOSE a level site with, if possible, the command of water at a higher level, any how with water handy. Either irrigating, or hand-watering, for seed beds is a necessity, if vigorous and well-developed plants are to be looked for.

The soil should be of the light friable kind recommended for the tea plant, (see "soil") and of the same *nature* as the soil of the garden, the ultimate home of the plants. This latter is

all important, for seedlings will never thrive (probably not live) transplanted into a new kind of mould.

If possible, the soil of the seed beds should be poorer than the soil of the garden, on no account richer. Taking care it is of the same *nature* as the garden soil, choose the poorest you can find. The principle is well known in England, and it applies equally in India. From poor to rich soil plants thrive, but never the other way.

For the above reason never manure seed beds.

Artificial shade for seed beds is a necessity, at least very many more seeds will germinate when it is given.

Natural shade over seed beds is *very* bad, for *firstly*, "the drippings," are highly injurious, and *secondly*, shade is only required till the plants are two or three inches high, after that *any* shade is bad, for plants, brought up to time of transplanting in shade, are never hardy.

Seed beds, where water is handy, should not be dug deep. If so dug, and the soil is consequently loose a long way down, the tap-root will descend quickly and will be too long when transplanted. As water can be given, when it is necessary, there is no need for the tap-root to go down low in search of moisture.* A long tap-root is generally broken in "lifting" the seedling from the bed.

Seed beds raised, as is the usual custom, above the paths that run between them, are objectionable. They part with moisture too freely. They should, on the contrary, be below the level of the paths, and there is another advantage in this, for the said paths can then be used, partly as supports for the artificial shade, and thus do away with the expense of long wooden stakes.

As the seed beds are only required until the beginning of

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* In planting "at stake" (see that Chapter) the conditions are different. There the plant is in its permanent home, and the more quickly and deeper the tap-root descends the better, as the plant will then draw moisture from low down, when the upper soil is dry.

the following rains, there is no possibility of their suffering from excessive moisture. Were they required to remain later, of course, this plan of making the beds lower than the paths would never do.

Seed is best sown in drills, six inches apart, and each seed two, or if space can be got even three inches from its neighbour. This facilitates each seedling being taken up later, with more or less of a ball of earth round the roots. An all important point (see transplanting.)

The length of the beds does not signify, but the breadth must not be more than five feet; so that a man on the path on either side can reach to the middle while hand-weeding, or opening the soil.

After what has been said no lengthy directions for making the beds are necessary.

Cut down, burn, or carry off all jungle, and then take out all roots, whether grass or other. Now make the surface level. After this, mark off the beds and paths, the latter one foot broad only, with string and pegs. Then raise the paths six inches above the spots marked off for the beds. This latter must not be done by earth from the beds, but by earth from outside the intended nursery. Next dig, and pulverise the soil of the beds to a depth of six or seven inches, no more, and level the surface.

All is now ready for the seed. A string, five feet long, with a small peg at either end, is given to two men who stand on the path at either side of the bed. Each man has a six inch measure. The string is laid across the bed, beginning at one end, and pegged down at either side. A drill is then made along the string, about one inch deep, and this done, the string is, by means of the six inch measure on either side, removed and pegged down again in the place for the next drill. Seeds are then sown or placed along the first drill made, two to three inches apart, and the earth filled in. This is repeated again and again, till the whole bed is sown.

If the character of the seed is doubtful, it must be laid in thicker, but with good seed two-and-a-half to three inches is the best distance.

The sowing finished, the artificial shade has to be given. Along the paths, at five feet apart, put in forked stakes two feet long, *viz.*, six inches into the path and eighteen inches above it. Connect these with one another by poles, laid in the forks; now lay other but thinner poles attached to these at either end, *across* and above the bed; and again across these latter, that is along *the length* of the beds, split bamboos, and then bind the whole frame-work here and there. The said frame-work made will then be two feet above the beds, *viz.*, eighteen inches of stake support, and the six inch raised paths. The eighteen inches of opening all round, under the frame, that is between the frame and the bed, allows the necessary air to circulate; while the expense, danger from high winds, and the objectionable entrance of the sun at the sides, all of which high artificial shade is subject to, is avoided by this low frame-work.

Mats are the best to cover the frame-work. In case of accidental or incendiary fire, they are not so objectionable as grass, for they burn less and slower, but mats are expensive. Any coarse grass (free from seed) will answer, and it should be laid on, as thin, as will suffice to give shade.

The beds may be watered, if there is no rain, a fortnight after the seed is sown, and from time to time, during the dry season, whenever the soil, at a depth of three or four inches, shows no moisture.

The soil should also be kept free of weeds, and after the plants are three or four inches high, the spaces between the drill should be slightly stirred every now and then.

After the seed has germinated, and the seedlings have, say four leaves on them, the artificial shade should be taken away. But it must be done gradually, taking off portions of the grass first, so that the young seedlings may by degrees be inured

to the hot sun.

Though cultivation, as described, by watering and opening the soil at times is well, these should not be done much, or the seedlings will be too large when the time comes to transplant them. Large seedlings do not, as a rule, thrive as well as moderate sized ones, after being transplanted.

Among the many very absurd mistakes made in the cultivation of the tea plant, none exceeds the ridiculous way tea seed used to be sown in the Government Plantations in the North-Western Himalayas. The seed was sown in drills, as I have advised, but in six linear inches of the drills where it is right to put two or at most three seeds, perhaps thirty were placed! I do not exaggerate; the drill six inches deep, was filled with them. Many and many lacs of seeds, in those days worth many thousand rupees, were thus sacrificed. Private planters in the Himalayas, taught by the Government method, once did the same. I believe the absurd practice is exploded now.

Seed cannot be sown too soon after being picked. It is ripe early in November, so the beds should be all ready by November, and if the seed has not far to come, it can thus be sown early that month.

To each maund there are in round numbers 30,000 seeds (see Chap. X.) The number of plants it will take to fill an acre, depends of course, on the distances they are set apart (see Chapter XV.) but having decided this point, also the area to be planted, and consequently the number of maunds of seeds to be sown, (see Chapter X.) the following table will be found useful in calculating the size of nursery required.

Table showing the size of Nursery required for 1 maund and 10 maunds seed, the drills being six inches apart, and each seed three inches or two inches from its neighbour.

Distance each seed is set apart in the drill.	Area, in sq. inches, each seed will occupy.	Area, in sq. ft. of beds, without paths, required for each md.	Area, including paths, required for each md.	Size of Nursery, including the paths, to take in for 10 mds.
3 inches ...	18	3,763	4,513 sq. feet or 501 sq. yards.	100 yards by 50 yards.
2 inches ...	12	2,500	2,995 sq. feet or 332 sq. yards.	100 yards by 33 yards.

If nurseries for more than ten maunds is required, then allow 100 yards to be the breadth, and for each extra ten maunds, add respectively 50 or 33 yards to the length. Thus 50 maunds will require nurseries 100 yards by 250 yards, or 100 yards by 165 yards, according as it is decided to plant the seed three inches, or two inches, apart in the lines.

CHAPTER XIV.

Manure.

An idea existed formerly got, I believe, from stray Chinamen who I don't think knew much about tea in any way, that manure, though it increased the yield, spoilt the flavour of tea. The idea is opposed to all agricultural knowledge, for high cultivation, which in no case can be carried out to perfection without manure, much improves the strength and flavour of all edibles, the product of mother earth.

My first experience of manure, to the tea plant, was obtained in the Chittagong District, from a small garden close to the station, which has been for some years highly manured. I was struck with the frequency and abundance of the flushes, and the strength and flavour of the tea. My

high opinion of the tea was later borne out by the Calcutta brokers, who think very well of it and sell it at a high price.

After-experience showed me that manuring nearly doubles the yield of plants, and that so far from injuring the flavour of tea, it improves it, while it adds greatly to the strength.

I shall therefore beg the question that manure *is* an advantage. If any planter doubts, let him try it, and his doubts will soon be solved.

Any manure is better than none, but I believe the best manure for the tea plant (always excepting night-soil and the excrements of birds which cannot be procured) is cattle manure. It is not heating like horse-dung and may be applied in large quantities without any risk. The fresher it is applied, in my opinion, the better, for it has then far more power. If mixed with any vegetable refuse, the bulk being increased, it will go farther, but I do not think it is intrinsically any the better for it.

Of chemical manures I know nothing, but I do not doubt some of them would be suitable, and that it would pay well to manufacture such in Calcutta, and send them to Assam and Cachar, where manure is not obtainable.

All garden refuse should be regarded as manure, and buried between the plants. I allude to the prunings of the bushes and the weeds, at all times, from the land. To carry these off the ground, as I have some times seen done, is simply taking off so much strength from the soil. The greener, too, all this is buried, the better.

When it is considered how much is taken from the tea plant, it is evident the soil will be exhausted, sooner or later, if no means are adopted to repair the waste. Where manure cannot be got, the waste must be made up, as far as possible, by returning all other growth to the soil. But manure *should* be got if possible, for it will double the yield of a garden.

The best way to apply it, if enough manure is procurable, is round each plant; not close to the stem (the rootlets by which the plant feeds are not there) but about a foot from it. Dig a round trench with a *kodalee*, about 9 inches wide, and 6 inches deep, at the above distance from the stem, lay in the manure, and replace the soil at top. If the plants are young the trench should be narrower, shallower, and 6 inches, instead of a foot, from the stems.

If enough manure is not procurable for this (the best plan) the most must be done with what can be got, as follows: If the plants are full grown, and there is say 4 feet between the lines, dig a trench down the centre and lay in the manure. The plants will then be manured on two sides. If the plants are young, lay the manure *near* them on two sides, if possible, but failing that, even on one side. The principle is to lay the manure at the distance the feeding rootlets are, and the older the plant, the greater distance these are from its stem.

As to the quantity. Say for plants four years old and upwards (if younger less will be an equivalent) one maund to 20 trees is a moderate dose, one maund to 15 trees a good dose, and one maund to 10 trees highly liberal manuring, and as much as the plants can take up.

Say in round numbers each acre contains 2,500 plants (4 by 4 a usual distance gives 2,722 plants as shown in next chapter) and say the manure is procurable at three annas a maund.*

The following table shows the expense of each degree of manuring, *viz.*, 10, 15 and 20 trees per maund.

It is not too much to calculate that this will add respectively 1½, 2, and 2½ maunds of tea per acre to the yield, and I have carried this out in the table, and shown the results.

I quite believe, the results shown, will be obtained by

* It is brought and placed between the lines, in one garden in the Chittagong District, for two annas a maund!

manuring, and I base my opinion on practice not theory.

My only experience is with cattle manure. I know not what quantities of chemical manure would suffice, nor what the results would be.

Table showing the possible cost and result of manuring with cattle-manure.

Rate of manuring.	Maunds of manure per acre at 2,500 plants per acre.	Cost of manure at 3 annas per maund. *N. B.*—Ans. omitted.	Probable extra yield of tea per acre.	Value of extra yield of tea at Rs. 50 per maund	Profit by manuring per acre.	Deducting the probable cost of putting in the manure, the following profit is shown per acre.
	Mds.	Rs.	Mds.	Rs.	Rs.	Rs.
One md. to 10 plants ...	250	47	2½	125	78	70
One md. to 15 plants ...	166	31	2	100	69	62
One md. to 20 plants ...	125	23	1½	75	52	46

N. B.—I have deducted Rs. 8 for the first, Rs. 7 for the second, and Rs. 6 for the third, as the probable cost of putting in the manure as it may have to be carried from the factory to the garden. If purchased, after being placed between the lines, (and if manure is bought of adjacent villagers, they will so place it) the cost would be less.

The above table, of course, only applies to localities where cattle manure can be purchased at 3 annas per maund, including carriage to the factory.

The value of the extra yield of tea is estimated at only Rs. 50 per maund, in the above table, because the leaf which

will give one maund of tea is worth no more, as follows:

	Rs.	A.	P.
Probable price obtainable for one maund or 80 lbs. Tea in Calcutta, at 14 annas a lb. all round, (a fair calculation, one year with the other, if it is well manufactured) ...	70	0	0
Deduct cost, manufacture, packing, transport, and broker's charges as set out in the chapter on "cost manufacture" ...	16	9	0
Value of leaf which will make 1 maund tea	53	7	0

But I prefer estimating it at Rs. 50 only, to be on the safe side.

CHAPTER XV.

Distances apart to plant Tea bushes.

When the idea existed, which it did once, that ploughs could be used to cultivate a garden between the lines, these latter, with this object, were placed unnecessarily wide apart.

All distances may be seen in different gardens, *viz.*, 6 × 6, 6 × 3, 6 × 4, 5 × 4, 5 × 5, 4 × 3, &c., &c.

The plough-idea has no where been found to answer, and is exploded. Still, even for hand labour to cultivate, and for facilities in picking leaf, it is necessary there should be room enough one way to pass along. Cultivation here means digging, and space enough for this must be left between the lines. Giving, so much, what is then the principle that should guide us? Clearly, with a view to the largest yield obtainable, to place as many plants on the land as it will bear.

Four feet is I think the best distance between the lines. It gives space enough for air, to cultivate, and to pass along, even when the trees are full grown. It is, however, too little in poor soil, and 4½, or even 5 feet, may there be given.

Where manure is obtainable and the soil can be kept up to

a rich state by yearly applications, a garden can scarcely be planted too close.

I see no objection to trees touching each other in the lines, and advise therefore 3 or 3½ feet there, the former where the soil can be periodically manured.

On considerable slopes, to prevent the wash of soil, the plants should be placed as close as possible say 3½ between, and 2 feet in the lines.

A closely planted garden will grow less weeds than a widely planted one, and will consequently be cheaper to work.

As the expenditure on a garden is in direct proportion to the area, and the yield in direct proportion to the number of plants, (always supposing there is power enough in the soil to support them) it follows that a closely planted garden *must* be very much more profitable than the reverse.

The following is a useful table :

Table showing the Plants to an Acre, and the Acres one lakh of seedlings will cover, at the distances named.

Distances in feet.	Square feet to each plant.	Plants in one acre.	The area in acres one lakh of seedlings will cover.
6 by 6	36	1,210	82½
6 „ 5	30	1,452	69
6½ „ 4	26	1,675	59¾
5 „ 5	25	1,742	57½
6 „ 4	24	1,815	55
6 „ 3½	21	2,074	48
5 „ 4	20	2,178	45½
6 „ 3	18	2,420	41¼
4 „ 4	16	2,722	36¾
5 „ 3	15	2,904	34½
4 „ 3	12	3,630	27½
3½ „ 3½	12¼	3,555	28
3½ „ 3	10½	4,148	24
6 „ 3¼	19½	2,233	44¾
5 „ 3¼	16¼	2,726	36¾
5 „ 3½	17½	2,489	40
3½ „ 2	7	6,223	16

CHAPTER XVI.

Making a Garden.

I HAVE not very much to say on this head, as most of the operations entailed are treated separately. Still a few directions on primary matters are required.

Having selected a site and made arrangements for the tea

seed required for the first year's planting, you should commence operations, early in October, either by constructing the nursery, or clearing land on the proposed site of the garden, as you may decide which mode of planting, *viz.*, "nurseries" or "sowing at stake" to adopt.

If the latter, you should begin to cut the jungle, somewhat earlier, but it is no use beginning to do this before the middle of September in any case, for before that the jungle would spring up again so soon, it would be labour lost.

Even if your climate is well calculated for stake planting, I recommend your doing only a portion that way the first year at all events. You could never get the whole area to be cultivated, the first season, ready in time to do all in situ, that is at stake.

Before you do *anything*, decide how much you will cultivate the first year, and make your arrangements for seed accordingly. Here let me advise you, in no case, to attempt more than 40 acres. If you do 40 really well the first year, you will have done *very* well. Remember you have also buildings (though few) to construct, and trying to do too much, you may simply fail in all.

Previous to October, you should have made yourself thoroughly acquainted with all your land, so that you can then fix with knowledge on the best sites for your buildings, nursery, and tea plantation.

You will find much on these matters in other chapters which should be read carefully.

These respective sites having been fixed upon, and supposing you are going to plant in both ways, from nurseries and in situ, construct the nurseries as advised under that head, and also cut the jungle on the intended garden site.

There is not much to say about cutting jungle. Cut all the brushwood first near the ground, and the big trees later, so that when they fall they may lie on the underwood. In the portion you intend to plant at stakes, you will not have

time to cut down the big trees, and had better simply "ring" them. If this is properly done, that is if the ring is broad enough, and deep enough (less than one foot broad and five inches deep, for large trees is not safe) they will certainly die in a twelvemonth, and will not give objectionable shade, more than half that time. In the part to be planted "at stake," you must burn all the cut jungle end of October, and it will be well, if you have labour enough, to send men up the big trees to cut off the branches before-hand, so that they will more or less burn with the rest. Doing this, and piling up the underwood to be burnt round the base of the big trees, will cause earlier death, and diminish the objectionable shade.

Having burnt the jungle, that is as much as *will* burn, and carried off the rest from the part to be planted at stake, dig out all the small roots, and that done, dig the whole some 4 or 5 inches deep. Then stake it off with small bamboo stakes 18 inches long, showing where the tea trees are to be (see Chapter XV. as to the best distances) and then make your holes, and plant your seed at each stake, as directed in Chapter XII.

See the way it is recommended to stake land as regards its lay in Chapter VII.

You will probably not have the ground ready before the end of November, (do not attempt more than you can do up to that date) and take care and keep the seed, as directed in Chapter X. until it is sown.

For the part to be planted from nurseries the following June, you have plenty of time. No where have I, or any one, seen large vigorous tea plants under trees. It is therefore evident trees are hurtful, and no more should be left in a garden, than are required for the labourers to sit under occasionally, and to collect leaf under, before it is taken to the Tea House. The trees that are left should be those on the sides of roads. One to every 2 or 3 acres is ample. After therefore cutting

down all the low jungle, cut down all but the said few trees (it is cheaper in the end than ringing them) and then cut off, and cut up all the branches, into sizes that will burn readily. Cut up the large trunks, also into lengths, for all that will not burn must be carried off later. Leave all so lying until February, then choose a day with a high wind and fire it from the windward side. It may burn some days. Then collect all unburnt into heaps, and fire again, and again, until nothing more will burn. Now take out all roots, big and small, and when well dry, stack all these, and what was left before, and fire again and again. The land should now be tolerably clear and can be dug at once. The roads should be marked off before this for they are better not dug.

Now stake the land, at the distances determined on, and a month before the rains, or even more, if you are so far advanced, make holes for the young seedlings at each stake, precisely like those recommended for "planting at stake" (Chapter XII.) Only, if possible, these should be a little larger each way, than there advised, say 10 inches diameter, and 15 inches deep.

Read carefully the direction as to those pits, and follow them out here. Much of the success of your planting depends on these holes.

At the first commencement of the rains transplant, as directed, under that head.

Any large heavy trunks, which cannot be easily carried off the land, may be placed longways between the lines, but the less of dead timber you leave lying about the gardens the better.

CHAPTER XVII.

Transplanting.

If the pits for the plants have been all prepared, as directed in Chapters XII. and XVI., this operation is simple enough. A fortnight or so before it commences, tip all the seedlings

in the nursery. Take off only the closed leaf at the head of each young plant (see a leaf diagram, Chapter XXIII.) so that the bud at the base of the next leaf be not injured. Doing this will make the seedlings hardier, and enable them earlier to recover the transplanting.

On the day you intend to take up the seedlings from any bed, if you have water enough at command, flood the bed. This as you take up, each seedling will cause the soil, being moist, to adhere better to the roots.

The difference between young plants transplanted with a ball of earth round the roots, and those moved with their roots bare, is no less than three months growth, if even it does not make the difference between life and death.

Proceed thus to insure the former. At one long end of the bed, the lowest if it is on a slope, dig close to the first row of seedlings a trench, so deep, that its base shall be lower than the lowest end of the tap-roots. Then, with a five-pronged steel fork, (this is better than a spade, for it does not cut the rootlets) put in between the first and second row, and pressed down with the foot to its head, force carefully so much of the row down into the trench. Then with the hand take up each seedling, separately, helping the soil with a very light pressure (so light that it shall not change the lateral direction of any of the rootlets) to adhere, and place it in a low basket, sloping. Do this again and again, till two baskets are full, when they will be carried, banghy fashion, to the garden.

When the first row is finished, clear away the loose soil, so that a similar trench, to the first, shall be formed, and then proceed as above with the second row, and so on.

No further directions, for lifting the seedlings out of the nurseries, are required.

All is ready for their reception in the garden if the directions in Chapter XVI. have been followed out. The work now to be detailed must be done by careful men, well superintended.

In the soft soil of the lately filled up pit, described in Chapter XVI., a hole is made, either with the hand or a narrow kodalee, (the former, if the soil has not settled much, will suffice) large enough, and deep enough, to take in the seedling with all the earth attached to it. The seedling is then put in, and the soil filled in and round it, which completes the operation.

The manner, though, in which this is done, is of great consequence. Four things are all important. (1), that the tap-root shall not be turned up at the end, because the hole is too shallow. (2), that any rootlets projecting outside the attached earth, shall be laid in the hole, and shall preserve when the soil is filled, in their lateral direction. (3), that the collar of the plant (the spot where the stem entered the earth in the nursery) shall be, when the pit is filled up, about one and-a-half inches higher than the surface of the surrounding earth. (4), that in filling in the hole, the soil is pressed down enough to make it unlikely to sink later, but not enough, to " cake" the mould.

The following is the consequence of failure in these four points :

1. Probably death, in any case very much retarded growth. I have planted some seedlings so purposely; the majority died; those that lived recovered very slowly, and digging them up, later, the tap-root was found to have gone down after all, by assuming the shape of the letter S, the growth downwards being from the head of the letter.

2. Rootlets, turned away from their lateral direction, interfere with other rootlets, and though they eventually grow right if the plant lives, they retard it.

3. Fill in as you may (unless you " cake" the soil, which induces worse evils) the plant sinks a little; thus, if not placed a little high, it will eventually be too deep. If on the other hand placed too high, the rootlets and collar will be exposed, which is an evil.

4. Unless this is attended to, the plant will sink too much,

and the collar be buried; likewise an evil, which it takes the young seedling some time to recover.

Only first teaching, and then practice will enable either European or Native to plant well. This is how it should be done.

Take the seedling in the left hand, holding it by the stem just above the collar; then take the very end of the tap-root between the second and third fingers of the right hand, and thus put it down into the hole (you thus insure the tap-root being straight.) Now judge exactly the height of the collar, that it be as directed. Rest the left arm then on the ground, to keep the plant steady, release the tap-root, and fill up the hole about one third, pressing the soil lightly. The plant will then be fixed, and you can employ both hands to fill up the remainder, and keep the rootlets in a lateral position. Press the soil lightly as you do so, and when all is filled up, press it down a little harder round the stem of the plant.

All the transplanting should be finished as early in the rains as possible. A seedling, planted in the first fifteen days of June, is worth two planted in July, and, after the first twenty days of the latter month, it is generally a case of seedlings and labour lost.

Days with heavy rain are not good to plant in. Those with showers or light drizzling rain are best. When there is very heavy rain, the soil "cakes" much. Fine days, if the ground is wet, and if more rain may soon be looked for, are good, better though if cloudy than sunny.

Where much planting though has to be done, of necessity planting must be carried on daily for, as observed, it *must* all be finished by 20th July at latest.

In case though of a sunny break in the weather, stop planting after the second day, for early rain, to young transplants, is a necessity.

In making a garden, too much care cannot be given to the way seedlings are placed in their homes.

CHAPTER XVIII.

Cultivation of made Gardens.

As manuring, which is part of this, is treated separately, we have here only to consider the best means of stirring the soil to give air to the roots of the plants, and to keep down weeds which, if allowed, injure the yield vastly.

Unless when plants are full grown, and in full bearing, (and not even then unless they are planted close) it is not only not necessary, but a waste of labour and money, to open the soil all over the garden with a view of stimulating or cultivating the plants. Much money has been wasted in this way, for instance in a garden planted 6 by 6 or 6 by 5, and the plants, but two years old, I have seen the whole dug many times in the year. The roots of the said plants did not protrude at that age more than a foot or so, what good could they possibly derive from the extra space dug ?

The soil over the rootlets of tea plants cannot be stirred too often. The oftener it is done the oftener the trees will flush, and when young, the more vigorously will they grow. What is the best way to do it ?

I believe simply by digging *round* each plant. I go to show why this is, I believe, the best.

Putting aside the waste incurred in digging a whole garden when not necessary, the way the soil is then dug near the plants is, I think, objectionable. The ground is dug in a straight line *up to the plant*, and in doing so, if the digging is deep, roots are very apt to be cut. Again, when the work is task-work, the men shirk as much as possible digging close up to the stems under the branches, and thus the soil, over much of the roots, is not stirred at all.

In "digging round plants" the men should *follow* the kodalee round the tree, and *the position of the blade in the same line as the roots* makes any injury very unlikely. Even if tasked, as when the work is examined, it is *only* round the plants, it is more readily perceived if the ground has not been stirred close

up to the stems.

I therefore prefer digging round plants, with the view of cultivating them, to digging the whole garden. I believe the object is better attained. That it is much cheaper is evident.

The annulus, or space to be dug round beginning nine inches from the stem, varies with the age of the plant. Up to two years one kodalee in width will do, and after that, say two feet.

The draw-hoe, of eight inches wide, is a better tool for the above than the kodalee, especially as it is work well suited to boys, and the "draw-hoe" is a lighter tool.

Till plants from seed at stake are a year old, and till seedlings from nurseries are the same age, calculating in the latter case from the transplanting, no kodalee or even draw-hoe should come near them. The soil round for six inches should be slightly opened once a month or so, but it should be done with "the koorpee."

We have now discussed the cultivation of the plants. The above often done, say once every fifteen or twenty days if possible during the season, with judicious pruning, and liberal manuring, constitutes high cultivation. Did weeds not grow, there would be no need to do more, but weeds *do* grow and must not be allowed. The richer the soil the more weeds, the more manure you apply, the more weeds also.

Weeds choke the plant and diminish the yield. Weeds take from the soil, and from manure when given, the strength you want for your constantly recurring flushes. If, therefore, you have a large crop of weeds, you will have a small yield of tea.

How to stop this? There is one golden rule "never let them get a-head of you." This it is true argues ample labour, but unless you *have* ample labour, for the area you cultivate, better let your money lie in the Bank and not grow tea. Reduce your area, until you *can* keep a-head of your weeds, for keep a-head you must, if you wish for success.

The secret of keeping a-head of weeds is to destroy them

when young, to do this again and again, as often as they come up, never allowing them, to bear seed. The kodalee, an excellent digging tool, is not good for this, you want a lighter instrument, which can go over more ground and will not open the soil, in the dry season, to any depth. The Dutch hoe, the widest procurable in the blade, with a long lithe handle of six feet, is perfect for this.

With weeds, at the height fit for a Dutch hoe, *viz.*, three or four inches and not numerous (which they will not be if you have " kept a-head") a man will easily do 45 square nulls *id: est.* 720 square yards. He would not do more than 30 nulls with a kodalee.

The Dutch hoe must be well known. It is used for weeding drives and walks in England.

To conclude shortly for " hoeing and weeding," I recommend as follows :

Dig the whole garden thrice in the year, *viz.*, spring, rains, and autumn. Bury all weeds, as you dig, in trenches between the lines.

In the intervals, use the Dutch hoe, as often as weeds appear.

Cultivate the plants, by digging round them every fifteen or twenty days if possible.

Do all this and you will find your garden is kept clean, and well cultivated, at far less cost than you incurred for cultivation when it was choked with weeds for months together, while your yield will be at the same time much increased.

CHAPTER XIX.

Pruning.

It is stated elsewhere, at length, in Chapter XXII., *why* I conceive pruning to be necessary for the tea plant. Whether I am right or not, the fact is certain, that without pruning very little leaf is produced.

Pruning must be done in the cold weather, when the plant

is hybernating, that is to say, when the sap is down. The sooner *after* the sap goes down, it is done the better, for the sooner the tree will then flush in the spring.

There have been many theories about pruning tea bushes, but none I think worth much *practically*, for the simple reason that it is impossible to prune 250,000 plants (the number in a 100 acre garden, at 2,500 to the acre* with the care and system a gardener prunes a favourite fruit tree. The operation *must* be a coarse one, done by ignorant men, in large numbers at one time, who can in a measure be more or less taught, and the nearer they do right the better, still really careful and scientific pruning can never be carried out on a tea plantation.

The time to do it too is very limited. It cannot be begun before the trees have done flushing, say, at the earliest, middle of November, or continued, if early flushes and a large yield next season is looked for, beyond middle of January, at the latest. Thus at the most, two months is all the time given.

I shall confine myself therefore to giving such directions as will be practically useful.

The best instrument is the common "pruning knife." It cuts far cleaner than the "shears," besides which, the Natives very seldom use the latter well. What is called in England a "hedge-bill" is useful to trim the outside of the trees. If required, it must be got from England, as I do not think it is procurable in Calcutta. Whatever instruments are used should be kept very sharp, and for this purpose, besides sharpening them every morning on the grind-stone, each pruner should be provided with a small pocket "hone."

The theory, and it is correct, is, in pruning, to cut near above a bud or branch, but not near enough to injure them. The cut should be quite clean and sloping upwards, so that

* In a 500 acre garden, and there are such, the number is 1,250,000, which *ought* all to be pruned in two months.

nothing can lodge on it. This theory can be, and must be, strictly carried out in cutting the thick stems and branches, but it is quite impossible to do it with the slender branches or twigs of the tree.

Prune so as to cause lateral growth. A tea plant should never be allowed to exceed say, four feet in height, but the wider it is the better.

Prune off all lower branches tending downwards, for the plant should, if possible, be clean underneath, to a height of say six inches. This clean stem, high class plants have naturally; not so the China, or the Chinese caste of hybrid.

Plants should be more or less pruned out in the centre. In the following spring, young wood is then formed in the heart of the tree, and it is only young wood and shoots that give leaf.

Plants exceeding 2½ feet in height at the end of the season (and all plants of any age will) may be pruned down to 20 inches, but the thick wood must be pruned down to varying heights, several inches lower.

Small plants must, naturally, be more lightly pruned.

The best plan is, I think, to have two gangs.

The first to go a-head and cut out the thick wood (here judgment is necessary, so let them be the best men) to varying heights, from about twelve to eighteen inches. The second gang to follow, each with a rod twenty inches long, to cut down all the light wood left to that level.

All plants, how low or how young soever they may be, must be pruned somewhat. The lower their stature, and the less their age, the less pruning they require.

Of the two extremes, at least with the tea plant, it is probably better to over, than to under prune. The treatment of the plants, with reference to the leaf to be taken in the spring, must be a good deal regulated by the way, or rather the extent, to which they have been pruned. On this point see Chapter XXII.

Let all prunings be buried, between the lines of plants, if possible, before the leaves have even withered. They make capital manure, but much of the virtue escapes, if they are allowed to lie on the ground any time, before they are buried.

CHAPTER XX.

White-ants, crickets; and blight.

Both these insects are very destructive to the tea plants. The cricket, however, only injures it when quite young, so we will consider that little pest first.

When tea seed germinates, and the young seedling is two or three inches high, the cricket delights to cut the stem and carry, or try to carry, the two or three green leaves attached to the upper part into its hole. Even after seedlings are planted out, if the stems are slender, it cuts them. To the young seedlings, in nurseries or planted "at stake," they often do great harm, killing in some places one-third or so.

It is much easier to prevent their ravages in nurseries, than in this latter case, simply because the spot in which they must be sought and destroyed is circumscribed in the one, almost unlimited in the other.

Only one thing can be done. Employ boys (they soon get clever enough at the work) to hunt for their holes, and dig them out. The holes are minute, but run down a long way. The only plan to follow them is to put in a thin pliable stick and remove the soil along it. On getting to the bottom of the stick, if it is not the bottom of the hole, you repeat the operation till you *do* get to the bottom, and there you will generally find the cricket.

Early in the morning they can be often found and caught outside their holes. The boys employed should be paid for them by the number they catch. They can be placed alive, and brought to the factory, in a hollow bamboo, and then killed in some merciful way.

When once a tea plant has got a stem, as thick as a thick pencil, no cricket can hurt it.

They are much worse in some places than others, and in my experience I have found them worse on low lands.

The white-ant is a much more formidable enemy than the cricket. They *do* (as all planters know) attack and destroy living bushes.* Whether they first attack some small dead portion, or not, is a question, but practically it does not signify the least, for if they do, they manage to find such in about one-third of the trees in a garden. Beginning with the minute dead part, they kill a-head of them as they go, and will eventually, in many cases, if left alone, kill the largest trees.

They have a formidable enemy in the small black ant which exist in myriads and kills the white-ant, whenever the latter is not protected by the earthen tunnels he constructs. In many places, so great is the pest, did this small black ant not exist, I believe no tea garden could stand.

From the close of the rains to the cold weather is the worse time for white-ants, and the time the planter should guard particularly against their ravages. At that time, if he examines his trees closely, he will very likely find white-ants on a quarter of the whole.

Digging round the plant where they are disturbs their runs and does much good. At the same time they should be brushed off any part of the tree they have attacked, and the tree should be well shaken.

All this, however, only does temporary good, for they often are found as thick as ever on the plant, a week later.

Tobacco water is beneficial, but in wet weather it is soon washed off. I have tried also a preparation, advertized by Burn and Co. for white-ants, but have only done so quite lately, and so cannot pronounce on it. I advise others to try it.

* A long controversy on this point lately took place in the papers.

Kerosine oil is *very* efficient. A little is put round the stem, but it is expensive. The next best thing I know is the earth-oil (petroleum), from Burmah, and this is cheap enough. It is thick, but used from a bottle, it gets heated by the sun, and is then quite limpid.

When white-ants are found on a tree, a little; with a small brush, is put on the part they have attacked. They are also well shaken off, and a ring of oil is placed round the stem. My experience is that they will not attack that tree again for a long time. I was at first fearful that both it and the kerosine (the one is I believe only a manufacture of the other) would injure the trees, but I used the kerosine largely last autumn, and it did no harm. I am now using the earth oil, and do not believe it will injure the trees either. I strongly recommend others to try it, if they doubt, on a small spot only, in the first instance.

Whatever is used, or whatever is done, white-ants must not be left to work their will in the autumn. All the trees should then be examined once at least, and once again, if possible, the following spring.

Blight (a serious matter I hear in Cachar) I know but little of. I do not remember hearing anything about it, when I was there, now six years ago. It is rare in the Chittagong district, but I have seen one or two trees attacked with it. Under its influence, the young leaves get covered with brown spots, and shrivel. It is most destructive to the yield of a garden.

From one or two experiments made, I believe pruning off all the diseased branches, and scraping back the soil for a space of two feet round the stem, so as almost to lay the roots bare. will be found beneficial, but I do not speak with certainty.

All the Himalayan gardens, I have seen, are entirely free from these three pests detailed.

CHAPTER XXI.

Filling up Vacancies.

So difficult is this to do, I have heard several planters declare they would attempt it no further, but on the contrary accept the vacancies in their gardens as an unavoidable evil.

That it is difficult, I too can certify. Seedlings put into vacant spots year after year, die, either in the rains they are planted, or the following spring. If, however, a few yards off, a fresh piece of land is taken in and planted, the plants live. What is the reason? It can be nothing connected with the soil, for on adjacent spots they live and die.

It puzzled me a long time, but I *believe* I can now explain it. First, seedlings planted in vacant spots in a garden are never *safe*. When, in the rains, there are many weeds in the gardens, and it is being dug, the young seedlings are not observed, are either dug up, or injured so by the soil being dug close to them, that they shortly after die. This is, I believe, the *principal* cause of the failure, and it may be in a great measure, if not entirely, obviated by putting *first*, a high stake on either side of the seedling, and taking care they remain there all through the rains. *Secondly*, as an additional precaution, and a very necessary one, before any such land is dug, send round boys with " koorpies" to clean away the jungle round the young plants, and at the same time open the soil slightly over their roots. Doing this " cultivates" them, and the plants being apparent, with the newly stirred vacant spaces round them, are seen by the diggers, and are not likely to be damaged.

The second cause of failure, I attribute to the old plants, on either side of the young seedling, taking to themselves all the moisture there may be in the soil during any drought. The young seedling, whose tap-root at the time is not a long one (for it is in the spring of the year, following the year of planting that this occurs) is dependent for life, entirely on the small amount of moisture that exists in the soil, at that insig-

nificant depth (say eight inches). But on two sides of the said seedling's tap-root, and in fact surrounding it, if the neighbouring tea bushes are full grown, are the feeding rootlets of the big plants, sucking up all the moisture attainable (the necessities of *all* plants being then great) and leaving none for the poor young seedling, which consequently dies, in the unequal contest.

This last evil (in climates where there is a deficiency of spring rains, and in fact more or less in all tea localities, for in none is there as much rain as the plants require in the spring) there is no means of avoiding as long as seedlings, after transplanting, *lose time*, the effect of the transplanting, and thus fail to attain a good depth before the said dry season.

In fact unless something is devised, I believe with many, trying to fill up vacancies is a loss of time and money.

The pits to plant in, advised in a previous Chapter should of course be made in these vacant spots, for they help much towards the early descent of the tap-root. Still they can scarcely avail sufficiently, to avoid the evil, if the plant is lying inert as is generally the case, for two or three months after planting. This delay being moreover in the rains, the best growing time.

If we can devise any means to avoid this delayed growth in the young seedling after it is transplanted, then the tap-root, before the drought of next spring, will have descended low enough to gather moisture for itself; that is from a *lower* depth, than the greater number of the rootlets of the neighbouring big plants traverse. Could this be done, and if the means, above detailed, are resorted to, to prevent the young plants being injured when the gardens are dug, I see no reason why vacancies should not be successfully filled up. Then might be seen, what nowhere can be seen now, a tea garden full of plants, that is with *no* vacancies.

When it is considered that many gardens, in all the districts

have 30 or even 40 per cent. vacancies, none less than say 12 per cent., we may strike a fair average and roughly compute the vacancies in tea gardens throughout the country at 20 per cent. In other words, the yield of tea from India, with the *same* expenditure now incurred, would be one-fifth more were plantations full! That is to say, the existing gardens in India instead of producing twelve million pounds, which they do now, would produce nearer fifteen million!

I have shown how the first evil can be obviated. I *think* the following will obviate the second.

Get earthen pots made seven and-a-half inches diameter at the head and seven and-a-half inches deep, like the commonest flower pots, only these should be nearly as wide at the bottom as at the top. A circular hole, two inches diameter, must be left in the bottom. Fill these with mould of the same *nature* as the soil of the garden, where the vacancies exist. Put two or three seeds in each, all near the centre, and not more than half an inch below the surface. Place these pots, so filled, near water, and beneath artificial shade, as described in a previous Chapter.

When the seeds have germinated, and the seedlings have two or three leaves, so that you can judge which is the best class of seedlings in each pot,* root out all but one, the best one. Now remove the shade gradually, water from time to time, and let the seedlings grow in the pots till the rains. Having before the rains, made the holes at the vacancies as before described, after the first fall carry the pots to the garden and place each one near a hole.

Then plant as follows. Stand the pot on the brink of the hole, having previously with a hammer broken the bottom. Then crack the sides also, gently, and deposit pot and all in the hole at the proper depth. If not enough broken, the sides of the pot may now be further detached, nay even partially removed. Now fill up with earth to the top. Pieces of the pot

* By "best class," I mean the most indigenous class.

left in the hole, will do no harm; but it, the pot, must be sufficiently broken at the bottom to allow of the free descent of the tap-root, as also enough broken at the sides to allow of the free spreading of the rootlets.

If all this has been carefully done, so that the mould in the pot shall not have been shaken free of the rootlets, the seedling will not even *know* it has been transplanted. Its growth will not be delayed for a day, instead of two or three months; and by the time the dry season comes, the tap-root will have descended far enough to imbibe moisture. More than this if a little manure is mixed with the soil, filled in to the hole, the plant will be a good sized one by the end of the rains, and will give leaf the following year!

Another plan to effect the same object. Instead of pots, use coarse bamboo open wicker work baskets. The split bamboo forming the said wicker work about half an inch wide, the interstices about one quarter of an inch square. Let the diameter of the basket be the same at top and bottom, *viz.*, nine inches. The depth of the basket ten inches.

When the seedlings in the nursery are large enough, to enable you to select a good class of plant, transplant one into each basket previously filled with soil.* This being done, when the plants are very young, and there being *then* no difficulty in taking them up with earth attached to their short tap-roots and rootlets, they will scarcely be thrown back at all. Being near water, they can also be well tended. Put basket and all into the vacant hole at the beginning of the rains, and fill up as directed for the pots. The interstices will allow the feeding rootlets, to pass through, besides the basket rots quickly under ground, so quickly, it cannot impede the plant.

Seed is not sown at once in the baskets, as in the pots, because the baskets would not last so long. Even putting the seedling in it during (say) February, the basket, with the

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* Mind again this be of the same nature as the garden soil.

occasional watering necessary, will more or less, have rotted before it is put into the hole.

Whether the pot or the basket plan is better I cannot say, for I am now trying both for the first time. I believe both will answer well, and that their use will remove a *great* difficulty in tea cultivation.

I have concluded a contract for ten thousand pots and five thousand baskets, at half an anna each for both kinds. Two pice, to ensure the filling up of a vacancy, is not a large outlay!

CHAPTER XXII.

Flushing and number of Flushes.

THE tea plant is said to flush when it throws out new shoots and leaves. The young leaves thus produced are the only ones fit to make tea, and the yield of a plantation depends therefore entirely on the frequency and abundance of the flushes.

The way a flush is formed is fully explained under the head of "leaf picking." (Chapter XXIII.)

The number of flushes in different plantations varies enormously owing, *first* to climate, *secondly* to soil, *thirdly* to the pruning adopted, *fourthly* to the degree of cultivation given, and *fifthly*, though not least, to the presence or absence of manure.

How to secure all these advantages to their fullest extent is shown under those heads, and we have here only to consider what is a low, a medium, and a high rate of flushing per season.

In doing this we must speak of elevated (as Himalayan) gardens separately. The cool climate of heights makes it impossible for tea to flush there as on the plains.

Speaking generally of elevated gardens (the higher they are the shorter the period, and *vice versa*) six months may be considered as the average producing period, *viz.*, from middle

April to middle October, and during that time ten to twelve flushes may be obtained, which I believe, with high cultivation and liberal manuring, can be increased to 15.

Assuming 12 as the average, this will give a flush every 15 days during the six months.

In all localities with favourable tea climates, the plants flush both for a longer period and oftener, speaking generally also, in this case, of the four best localities, *viz.*, Assam, Cachar, Chittagong, and the Terai below Darjeeling (for even in these districts many advantages exist on one garden which do not in another) the following is an approximation to the flushing periods:—

Upper Assam.—February 25th to November 15th.

Lower Assam.—February 20th to November 20th.

Cachar.—February 20th to November 20th.

Chittagong.—February 25th to December 5th.

Terai below Darjeeling.—March 1st to November 20th.

The opening period is a little late in Upper Assam on account of the cold, and closes a little earlier for the same reason.

Lower Assam and Cachar are much alike.

The opening in Chittagong is not earlier, than in the two just mentioned, from want of early rains, but it continues later, on account of the low latitude and consequent deferred cold weather; I believe the period given for the Terai below Darjeeling is approximate, but here I am open to correction, having no certain data.

Roughly, then, rather more than nine months may be assumed as the flushing period for these districts. The next point is how *often* do gardens in these localities flush in that time.

Not very many planters can say, certainly, how often their gardens have flushed in a season, because they are picked so irregularly, and no account of the different flushes kept. Enquiring on this point, when I was in Cachar some six

years ago, 9 to 24 were the minimum and maximum, numbers given me at different gardens, showing how little was really known about it.

Such knowledge as I have on the subject is mostly derived from carefully kept records of my own garden in the Chittagong district. The plantation is all worked in sections, in the way described previously, and the dates given in the table below are the days each flush was finished (that is the picking was finished) during the seasons 1869 and 1870; 1869 being carried up to the end of the season, 1870 up to the date I write, *viz.*, the 8th day of October 1870.

In the table it will be observed there is a great difference between the two years. The section for which the dates are given was planted from seed beds in the month of June 1866. In 1869 it was therefore only three years old. This will partly account for the first flush occurring a month earlier in 1870 as it was then a year older, but fortunate early rains in 1870 had also much to do with it.

In 1869 there was no flush between March 22nd and May 6th, a period of 44 days; and in 1870, none between February 22nd and March 30th, a period of 35 days, a very long time in both cases, which is entirely accounted for by the dry weather prevailing at Chittagong in the spring (see under head of Climate) for in Cachar or Assam, two or three flushes would have occurred in that time.

There were 19 flushes in all in 1869, there are 22 in all in 1870 up to the time I write; and if the flushing continues from this date, *viz.*, 8th October 1870, at the same intervals as it did from that date in 1869, there will be no less than 27 flushes off this section this year!

In the table I give the intervals between each flush. It shows an average of 14 days in 1869 to 10 days in 1870 (up to this time) the difference is due to the increased age of the

plants, and the liberal manuring given in the cold weather 1869-70.

Flushes.	1869. Dates.	Interval in days.	1870. Dates.	Interval in days.
1	March 22 ...	......	February 22 ...	......
2	May 6 ...	44	March 30 ...	35
3	„ 29 ...	23	April 13 ...	10
4	June 11 ...	12	„ 25 ...	12
5	„ 23 ...	12	May 5 ...	9
6	July 5 ...	11	„ 14 ...	9
7	„ 17 ...	12	„ 25 ...	11
8	„ 31 ...	14	June 4 ...	9
9	August 10 ...	9	„ 12 ...	8
10	„ 21 ...	11	„ 22 ...	10
11	Sept. 2 ...	11	July 1 ...	8
12	„ 12 ...	10	„ 8 ...	7
13	„ 25 ...	13	„ 16 ...	8
14	October 9 ...	13	„ 25 ...	9
15	„ 22 ...	13	August 2 ...	7
16	Nov. 2 ...	10	„ 11 ...	9
17	„ 11 ...	9	„ 21 ...	10
18	„ 19 ...	8	„ 29 ...	8
19	Dec. 4 ...	14	Sept. 7 ...	8
20	......	......	„ 18 ...	11
21	......	......	„ 27 ...	9
22	......	......	October 5 ...	7
Average intervals between Flushes.		Nearly 14 days.	......	Very little over 10 days.

Such a result as is shown already for 1870, and the probable result of 27 flushes to the end of the season, could not be obtained without high cultivation and liberal manuring. The land in question has been manured every year since it was planted, but an extra dose was given in the cold weather of 1869-70. The ground is now very rich. It is right to state that, though there are other sections on the plantation as good as this, and one still much better, it is one of the best

as regards its flushing.

I think therefore 25 flushes in the season may be looked for on gardens in good tea climates, when high cultivation and liberal manuring is resorted to. Where manure cannot be obtained, I think, even if in other respects the land is highly cultivated, more than 20 flushes will not be obtained. Where neither manure nor high cultivation are given, above 15 flushes will not be got.

It seems to be a general idea with planters, (see diagram Chapter XXIII.) that when a flush is picked, the succeeding flush, at an interval of say ten days, are shoots, from the axis of the leaf down to which the previous flush was picked. Thus in diagram Chapter XXIII. supposing the shoot to be picked down to the black line above 2. The idea is the next flush will be a shoot springing from the same place, *viz.*, the axis of leaf *d*. But it is not so. In the above case it will take a whole month, after the said shoot has been picked, before the new shoot from the base of the leaf *d* is ready to take.

'Tis true, the flushes follow at about ten days from each other, but they are *other* shoots. The replacement of the shoot taken is a whole month in developing. I have carefully watched this and am sure I am right.

With similar treatment gardens in Cachar and Assam would probably give two or three more flushes in the season than Chittagong; because there the spring rains are much more abundant; and I am very certain, that, if the day ever comes, that manure in large quantities is procurable in those districts, and is applied, the yield on those gardens will be very large.

The difference between very small, and very large profits, is represented by 15 and 25 flushes, so I strongly advise all planters to cultivate highly and to get all the manure they possibly can. If even procured at a high figure, it (the manure) will pay hand over hand.

CHAPTER XXIII.

Leaf-picking.

THE first consideration is how to get the largest quantity of leaf, without injuring the trees.

To a certain extent, it is true, that the more a tea bush is picked the more it will yield. It appears as if nature were always trying to repair the violence done to the tree, by giving new mouths or leaves to breathe with, in place of those taken away. I may exemplify my meaning another way. A tea bush which has as many leaves on it, *as it requires*, will throw out tardily new shoots, and their number will be small. In other words, a plant from which the young leaves are not taken, grows gradually large and bushy and then gives up flushing altogether. It has all the leaves it *requires*, and it has no necessity to throw out more.

If, however, nature is too much tried, that is if too much violence is done to her, she sulks and will exert herself no more. Up to this point, therefore, it is well to urge her. How can we know when we have reached it?

Only general rules can be laid down. Experience is the great *desideratum* on this, and many other subjects connected with tea.

If the plant can always be kept in such a state, that the foliage, without being *very much so*, is still less than nature requires, I conceive the object will be attained.

The greatest violence is done to the plants when it is pruned, and reason would seem to argue that when this violence is repairing, that is when the first shoots in the spring show themselves, and until new mouths (or leaves) in sufficient quantities exist, until then, but little leaf should be picked.

Fortunately, moreover, while in the interests of the plant this is the best plan, it also is the mode by which the largest yield of leaf will be secured in the season. I go to show this.

The ordinary size of a good full grown tea plant, at the end of the season, is say 3½ or 4 feet high, and 5 feet diameter. It is pruned down say to a height of 2, with a

diameter of 3 feet. It is then little more than wooden stems and branches, and to any one ignorant of the *modus operandi* in tea gardens, it would appear as if a plantation so pruned had been ruined. The tree remains so during all its hybernating period, that is during the time it is resting and the sap is down, (this period is longer or shorter, as the climate is a warm or cold one, and it is always during the coldest season) but on the return of spring, new shoots start out from the woody stems and branches, in the following way. At the axis or base of each leaf is a bud, the germ of future branches, these develop, little by little, until a new shoot is formed of, say, 5 or 6 leaves, with a closed bud at top. Then if it be not picked the said bud at top hardens. At the axis or base of each of the said 5 or 6 leaves are other buds, and the next step is for one, two, or three, of these to develop in the same way and form new shoots. The original shoot grows thicker and higher until it becomes a wooden branch or stem. The same process, in their turn, is repeated with the new shoots. A diagram will make my

meaning clear. We here have a shoot, fully developed of six leaves, counting the closed leaf *a* at top as one, *viz.*, the leaves *a, b, c, d, e, f.* The shoot has started and developed from what was originally a bud at *K*, at the axis or base of the leaf *I. I.* In the same way as formerly at *K* a bud existed, which has now formed the complete shoot or flush *K a,* so at the base of the leaves *c, d, e, f,* exist buds 1, 2, 3, 4, from which later new shoots would spring. These again would all have buds at the base of the leaves, destined to form further shoots, which again would be the parents of others, and so on to the end of the season, or until the tree is pruned.

It will readily be seen the increase is tremendous. It is only limited by the power of the soil to fling out new shoots, and the *necessities* of plant, for as I have explained, when as much foliage exists as the plant requires, but few new shoots are produced.

Now supposing the shoot in the diagram to be, (with perhaps another not shown at *L*) the first on the branch *I. I,* in the spring (the said branch having been cut off or pruned at the upper *I.*) It is then evident the said shoot is destined to be the parent and producer of all the very numerous branches, and innumerable shoots, into which the plant will extend in that direction. It is in other words the goose which will lay all the future eggs. If, eager to begin tea making early, the planter nips it off, the extension on that part of the tree is thrown back many weeks. It may be taken off at 1, 2, or 3 (the black lines drawn show the proper way to pick leaf) the least damage will be done if it is taken off at 1, the most at 3.

The said shoot *K a* is the first effort of nature to repair the violence done to the tree by pruning. It is the germ of many other branches and shoots, and it ought *never* to be taken. I have, I hope, made so much plain.

There is, however, another consideration. Any shoot, left to fully develop and harden, does not throw out new shoots

from the existing buds 1, 2, 3, 4, so quickly, as one checked in its upward growth by nipping off its head. For instance, supposing the shoot under consideration *not* to be the first of the season, but on the contrary, to be a shoot, when the plant has developed sufficiently to make picking safe. If taken off at 2, then the new growth from 2, 3, 4, will be much quicker, than it would be had the whole shoot been left intact.

Our object then with *first* shoots should be to secure this advantage, without destroying any buds, and this we can do by taking off simply the closed leaf at the top (*a*). This must be done so as not to injure the bud at the base of the second leaf *b* (I have not numbered it, for there is no room in the diagram to do so) and we shall thus leave all the buds on the shoot intact.

Again here the interests of the plant, and profit to the planter, go hand in hand. The closed bud *a* in this case will be found very valuable. I go to show this.

The value of tea is increased when it shows " Pekoe tips." Only the leaves *a b* make these. They are covered with a fine silky whitish down and if manufactured in a particular way make literally white or very pale yellow tea,* which mixed with ordinary black tea show as " Pekoe tips" In ordinary leaf-picking, these two leaves are taken with all the others, but unfortunately, when manufactured with them, they lose this white or pale yellow colour, and come out as black as all the other tea.

As the season goes on though, this is less and less the case, till towards the end, nearly all the *a b* leaves show orange coloured in the manufactured tea. They are then never however *white* (the best colour) as they can be made when treated separately. No means have yet been devised to separate them *before* manufacture from the other leaf, and though sometimes picked separate, the plan has serious objections

* I mean manufactured tea. The infusion is called liquor.

(see later.) In the case however, of the first 2 or 3 flushes, the welfare of the plants demands that no more should be taken, and though the quantity obtained will be small, it will, if carefully manufactured, so as to make "white Pekoe tips," add one or two annas a lb to the value, when mixed with it, of one hundred times its own weight of black tea!

More will be found under this head in the tea manufacturing part. I now beg the question that the said downy leaves, taken alone, are very valuable.

In detailing the mode of picking I advocate, it would be tedious to go minutely into the reasons for each and every thing. I have said enough to explain a good deal, but will add any thing of importance. Of the latter are the following.

Tea can be made of the young succulent leaves only. The younger and more succulent the leaf, the better tea it makes. Thus *a* will make more valuable tea than *b*, *b* than *c*, and so on, *e* is the lowest leaf fit to make tea from, for though a very coarse kind can be made from *f*, it does not pay to take it. The stalk also makes good tea, as far as it is really succulent, that is down to the black line just above 2.

The leaves are named as follows from the teas, it is supposed they would make:

a.—Flowery Pekoe.
b.—Orange Pekoe.
c.—Pekoe.
d.—Souchong, 1st.
e.— „ 2nd.
f.—Congou.

Mixed together ... { *a*, *b*, *c*—Pekoe.
a, *b*, *c*, *d*, *e*—Pekoe Souchong.

If there be another leaf below, *f*, and it be taken, it is named, and would make Bohea.

Each of these leaves was at first a flowery Pekoe leaf (*a*), it then became a *b*, then *c*, and so on.

That is to say as the shoot developed, and a new flowery Pekoe leaf was born, each of the leaves below assumed the next lowest grade.

Could the leaves fit to make each kind of tea, it is proposed to make, be picked and kept separate, and each be manufactured in the way most suitable to its age, and the tea to be produced, the very best of every kind could easily be manufactured. But this cannot be; the price of tea will not allow it, and the labour to do it would moreover fail. It has been attempted, again and again to do it, partly, to the extent of taking the Pekoe leaves *a, b, c,* separate from the others (for the manufacture best suited to these upper leaves is not suited to the lower) but it has been as often abandoned, and I doubt if it is now practised anywhere. I am sure it will never pay to do it.

Picking leaf is a coarse operation. It is performed by 80 or 100 women and children together, and it is impossible to follow each, and see it is done the best way. They must be taught, checked, and punished if they do wrong, and then it will be done more or less right; but perfection is not attainable.

I advise the following plan in picking. Please refer to the diagram.

If the garden has been severely pruned (as it ought to be) take only the bud *a* for *two* flushes; then for *two* more nip the stalk above 1, taking the upper part of leaf *c*, as shown (done with one motion of the fingers). Then from the 5th flush take off the shoot at the line above 2, and by a separate motion of the fingers take off the part of leaf *c*, where the black line is drawn. By this plan, when the rains begin, the trees will show a large picking surface, for plenty of buds will have been preserved for new growth. After the month of August you may pick lower if you like, as you cannot hurt the trees. For instance you may nip the stalk and upper part of leaf *e* together, and separately the upper part of *f*.

The principle however of picking, is to leave the bud, at the axis of the leaf down to which you pick, intact.

Some planters pick all through the season at the line above 1 and take the *d* and perhaps the *e* leaf separately. I do not like the plan, for though it will make strong teas, the yield will be small. Moreover, the plants will form so much foliage : they will not flush well, and again they will grow so high, that boys who pick will not readily reach the top.

Shortly, the principle I advocate is to prune severely, so that the plant in self-defence *must* throw out many new shoots. To be sparing and tender with these until the violence done to the tree is in a measure, but not quite, repaired ; then, till September, to pick so much that the wants of the plant in foliage is never quite attained, and after September to take all you can get.

I believe this principle (for the detailed directions given, may be varied, as for instance when trees have *not* been heavily pruned) will give the largest yield of leaf, and will certainly not injure the plants.

CHAPTER XXIV.

Manufacture. Mechanical contrivances.

To manufacture your leaf into good tea is certainly one of the first conditions for success. It will avail little to have a good productive garden if you make inferior tea. The difference of price between well and ill-manufactured tea, is great, say 4 As. or 6 *d* a ℔, and this alone will, during a season, represent a large profit or none.

Fortunately for tea enterprize, the more manufacture is studied, the more does it appear, that to make good tea is a very simple process. The many operations, or processes, formerly considered necessary, are now much reduced on all gardens. As there was then, that is formerly, so there is now, no *one* routine recognized by all, or even by the majority ; still simplicity in manufacture is more and more making its way every where, and as the real fact is that

to make the best tea, but very few, and very simple processes are neeessary, it is only a question of time, ere the fact shall be universally recognized and followed out.

For instance, panning the "roll"* was formerly universally practised. Some panned once, some twice, some even three times! But, to-day, pans are not used in most gardens at all!! Other processes, or rather in most cases the repetition of them, have been also either discarded or abridged. But a short statement of manufacture in old days, and the simplest mode of manufacture now, will best illustrate my meaning.

One and a common old plan.			One plan to-day by which the best Tea can be made.		
Days.	Number of Operations.	Detail.	Days.	Number of Operations.	Detail.
1st	1	Withering.	1st	1	Withering.
	2	1st Rolling.		2	Rolling.
	3	2nd "	2nd	3	Fermenting.
	4	Fermenting.		4	Sunning (if sun.)
	5	1st Panning.		5	Firing (Dholing.)
	6	3rd Rolling.			
2nd	7	2nd Panning.			
	8	4th Rolling.			
	9	Sunning.			
	10	1st Firing (Dholing.)			
	11	Cooling and crisping.			
3rd	12	2nd Firing (Dholing).			
3	12	Total days and operations.	2	5	Total days and operations.

* In describing manufacture, I shall call the leaf brought in "leaf" until it enters on the rolling process. From that time until the drying over charcoal is concluded "Roll," and after that "Tea."

So much for simplicity, and I affirm, that no more than the five operations detailed are necessary. I shall try to show this further on.

In studying tea manufacture I first tried, in order to get reliable data to go on, to ascertain the effect of each and every operation, and not only that, but the effect on the made tea of each operation exaggerated and diminished. It would be tedious, and of no use, to set out in detail all the experiments I conducted, the results only I will try and give.

I began at the beginning. Why wither at all? I made tea (following out in each case, all the other processes detailed in the old plan) of 1*st*, totally unwithered leaves; 2*nd*, of leaves but little withered; 3*rd*, of leaves medium withered; and 4*th*, of leaves over-withered.

I arrived at the following results:—Unwithered, or under withered leaves, break in the rolling and give out large quantities of a light green coloured juice during the same process. The tea is much broken and of a reddish grey colour. The liquor is very pale in colour, cloudy, weak, soft, and tasteless.

Over-withered leaf on the other hand takes a good twist in the rolling, gives out but little juice which is of a thick kind, and of reddish yellow colour. The tea is well twisted, "chubby" in appearance, and blacker than ordinary. The liquor of an ordinary depth of colour, clear, with a mawkish taste.

The medium withered leaves made good tea, but I found the withering should be rather in excess of what is generally done, to ensure strength. I will show later to what extent I think leaf should be withered.

The next point was Rolling. I knew some planters rolled the leaf hard, others lightly. That is, some rolled with force till much juice was expressed, others with a light hand, allowing little or no juice to be pressed out. Which was the better?

After many experiments I arrived at the following:—Hard rolling gives darker coloured and stronger liquor, than light rolling. Hard rolling destroys Pekoe tips,* inasmuch as the juice expressed stains them black.

Light rolled tea has therefore many more Pekoe tips, than hard rolled.

Hard rolled tea is somewhat blacker than light rolled.

In all, therefore, but the point of Pekoe tips, hard rolling is better.

The next question was, what is the advantage of repeated rollings? I rolled twice, panning once between, *vide* old plan and found the tea as well made, and as strong as others rolled three or four times. I then decided to roll *no more* than twice. The second time was, I *then* thought necessary, as I found the leaf of the roll opened in the pan, and a second rolling was requisite to twist it again.

But what did panning do? I heard pans had been discontinued in some gardens. In what way was then panning an advantage? I made tea, fermenting it between the two rollings, but *not* panning it, and it was equally good. I tried again and again, but never could detect that panning caused any difference to either the tea, the liquor or the out-turn.† In short, though I never found panning did any harm, I equally found it never did any good. Its use is in fact, simply barren of *all* results.

I therefore dispensed with it. Having done so, why roll the second time at all? I experimented and found the second rolling as barren of results as the panning.

I had now got rid of operations 3, 5, 6, 7, and 8 in the old plan. The next was No. 9 "sunning." I made tea with, and without it, and found as follows:—

* Pekoe tips are the whitish or orange coloured ends that may be seen in Pekoe tea. See chapter XXIII., on Leaf-picking.

† The out-turn are the tea leaves after infusion.

Sunning between the fermenting and firing processes has no effect whatever on the liquor, or the out-turn, but it makes the tea rather blacker, and as it drives off much of the moisture in the roll, the firing process, after it, is shorter and does not consume so much charcoal. What little effect therefore it has, is good (for if not continued too long, it does not make the tea too black) and it is economical. I therefore decided on retaining it.*

Next came the operations 10, 11, and 12, *viz.*, "1st firing," "cooling and crisping, and 2nd firing." Where these are done (and they are done in some gardens now) the usual thing is to *half-fire* the roll the same afternoon and evening it is made, then allow it to "cool and crisp" all night, and finish the firing next day. I tried this plan, and also the plan I have now adopted, of doing the whole firing at one time the same evening. I tried the experiment again and again, and always found the tea, the liquor, and the out-turn was the same in both cases. In short that the three operations did no more, and no less, than the one. As the three entail extra labour and extra expense in charcoal, I abandoned them.

I thus reduced the twelve operations detailed, to five, and naturally by so doing, much decreased the cost of manufacturing tea. I in no way lay claim to having devised this simplicity myself. Part had been done by others, before I ever turned my attention to it, and I have done no more than help with many, to make the manufacture of tea a simple process.

I was now convinced, that, (though I had still much to learn regarding the said five processes) success was comprised therein and that to multiply them could not avail.

The next consideration is—What are the qualities desired in tea to enable it to command a good price at the public

* At the end of the season, however, sunning has more than the above effect. It then makes the tea "chubby" in form, of a reddish colour, and improves the strength of the liquor.

auctions, either in Calcutta or London? The brokers in these cases judge of the tea first, value it, and give their report and valuation to intending purchasers and sellers. From what appearances and qualities do they judge?

They judge from three things, *first*, the tea; *secondly*, the liquor; *thirdly*, the out-turn.

The Tea.—The colour should be black but not a dead black, rather a greyish black with a gloss on it. No red leaf should be mixed with it, it should be all one colour. The tea should be regular; that is, each leaf should be about the same length, and should have a uniform close twist, in all but "broken teas." (These latter are called "broken," *because* the leaf is more or less open and broken.) The tea should also be regular *of its kind*, that is if Pekoe all Pekoe, if Congou all Congou; for any stray leaves in a tea of another kind, if even of a *better* kind or class, will reduce its value. In the higher class of teas, *viz.*, Pekoes and Broken Pekoes, the more Pekoe tips that are present the higher, in consequence, will its price be.

The Liquor.—In taste this should be strong, rasping, and pungent, with, in the case of Pekoes, a "Pekoe flavour." There are other words used in the trade to particularise certain tastes, but the words themselves would teach nothing. Tea-tasting cannot be learnt from books. *If* the liquor is well flavoured; as a rule, the darker it is in the cup the better. But to judge of teas by the colour of the liquor alone, is impossible, for some high class teas have naturally a very pale liquor.

The Out-turn.—A good out-turn is generally indicative of a good tea. It should be all, or nearly all, one colour. No black (burnt) leaves should appear in it. A greenish tinge is not objectionable, but the prevailing colour should be that of a bright new penny.

Every planter should be more or less of a Tea-taster, and should taste his teas daily. After a time (particularly if he gets other teas to taste against his own) he will learn

to recognize, at all events, a good as against a bad tea, a strong as against a weak tea, &c. No tea should be put away with the rest, until it has been tasted. It may be burnt, or have other defects, not apparent till infused, and one day's bad tea will bring down, considerably, the value of a whole bin of good tea.

The fancy, amongst brokers and dealers, for "Pekoe tips" in all Pekoe teas, constitutes the *one* great difficulty in tea manufacture. If the leaves which give "Pekoe tips" (see chapter XXIII.) are separated from the other leaves, and manufactured separately and differently, that is rolled *very* little and *very* lightly, not allowed to ferment at all, but sunned at once after rolling, and if there is sun enough finished in the sun, otherwise, by a very light and gradual heat (best placed *above* the drawers in the Dhole-house) if this is done, I say, these will come out perfect "Pekoe tips" of a white colour, which is the best.

If *not* separated from the other leaf, but manufactured with it, the sap from the other leaves, expressed in the rolling, stains these said leaves, which are covered with a fine white silky down, and makes them black, like all the rest of the tea; the whole of which is then valued lower, *because* there are no "Pekoe tips."

Now in the latter case "the Pekoe tips" are there all the same, only they don't *show*. The tea is really just as good, in fact a shade *better* with black than with white, or orange tips,* but it does not sell so well, and as we cannot argue the brokers or dealers into a rational view of the case, we must humour their fancy (they are virtually our masters) and give them the Pekoe tips,—*if we can.*

How are we to do it? The plan of picking these small leaves separately, in order to manufacture them separately, does not answer. It is too expensive: it diminishes the

* It is better because "the tips" having been hard-rolled, give stronger liquor.

yield of a garden, and labour for it fails. All this is shown elsewhere. Is there any other way?

It may be done during some periods of the season, when there is not leaf enough on the garden to employ all the leaf-pickers, by setting a number of them to separate the said two leaves from the others, after the whole leaf is brought to the factory. This is expensive, but it pays, when there is labour to do it, for then the teas can be made very showy and rich with white Pekoe tips.

An ingenious planter, a Mr. McMeekin in Cachar, has invented a rolling table with the object of separating the said leaves. It is constructed of battens, and while rolling the leaf on it, many of the small leaves fall through. The said table is now well known in Cachar, and is in use in several gardens. I have tried it and find it in a great measure, answers its object, but the objection to it is that the leaf *must* be rolled lightly, and lightly rolled leaf, as observed, does not make strong tea.

The Pekoe tips may be, in a great measure, preserved by rolling *all* the leaf lightly on a common table. But then again the tea is weak, and the plan will not give so many Pekoe tips as McMeekin's table.

In short, in the present state of our knowledge, except by the hand process, (a tedious and expensive one, for separating the leaf,) strong teas and Pekoe tips are incompatible.

The difficulty is just where it was, and will so remain until dealers give up asking for Pekoe tips (not a likely thing) or till a machine is invented, to separate quickly and cheaply, the two said small leaves from the others, *after* they have been all picked together. That such a machine is possible I am certain, and the inventor would confer a boon on the Tea interest, far beyond the inventor of any other machine, for all the other processes *can* be done by hand without much expense, this cannot.

I may here notice, such machines and contrivances as

exist, for cheapening the manufacture of tea, or rather such as I know of.

Rolling machines have for their object the doing away with hand labour entirely for rolling the leaf. Kinmond's rolling machine is first on the list, for it is the best yet invented.

It consists of two circular wooden discs, the upper one moving on the lower, which is stationary, with an eccentric motion. The adjacent faces of the said discs are made rough by steps in the wood, cut in lines diverging from the centre to the circumference, and over these rough faces is nailed coarse canvas.

The leaf is placed between the discs and rolled by the motion described. The lower disc is arranged, by means of weights running over pulleys, so that it shall press against the upper, with any force desired.

The motive power, as designed by the inventor, is either manual, animal, or steam.

Mr. Kinmond showed me this machine, just after he had invented it, at the Assam Company's Plantations in Assam some 4 years back, and I have since seen it working by manual and steam power. With the former it is quite useless, for by no arrangement can sufficient, or regular force enough, be applied. With the latter it does very well, and on a large garden which will render the outlay for the machine and engine justifiable (the former is, for such a simple machine very expensive) it may probably eventually prove an economy.

Not having seen it under animal power, I can give no positive opinion as to how it would answer, but I see no reason why it should not do well. I believe wind-power, might, on suitable sites, be easily applied to it, and wind-power would certainly be the cheapest of any.

Another rolling machine was invented by a Mr. Gibbon, and a good deal used in Cachar. I have never seen it.

Kinmond's is, I believe, the best rolling-machine yet invented (though it is fair to state I know no other except by

report) but I do not believe in any tea rolling machine superseding *entirely* the necessity of hand rolling. A rolling machine may be, and is very useful, to roll the leaves partly, that is to break the cells, and bring the leaf into that soft *mashy* state that very little hand labour will finish it. No rolling machine yet invented, can I think do more than this, and it is I think doubtful, if any will ever be invented that will do more. Machines do not give the nice final twist which is obtained by the hand. I was told lately that most of the gardens in Cachar that had machines, had dropped them, and gone back to hand rolling. I cannot help thinking this is a mistake. They should use both, the hand rolling for the final part alone. Very few rolling-men would then suffice with aid of the machine, to manufacture a large quantity of leaf.

I only know of one other tea-rolling machine which is "Dickinson's." It does not profess to do more than *prepare* the green leaf for rolling, which as stated above, is I think all that any machine will ever do. I have never seen it working, but it appears simple being nothing more than a mangle. The leaf is placed in bags, and then compressed under rollers, attached to a box, weighted with stones. The prospectus states, it will prepare 80 lbs green leaf in fifteen minutes, and that one man can then finish as much of such prepared leaf in three minutes, as would occupy him twelve minutes if the same had not been prepared. I see nothing unlikely in this. The machine, though inferior to Kinmond's in its arrangement, *ought* to be cheap enough to bring it within the reach of all *

I have already spoken of one of McMeekin's inventions. His chest-of-drawers for firing tea is, I think superior to

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* Unfortunately it is not. It is advertized at Rupees 300, with a yearly royalty of Rupees 50 the first year and twenty after. The royalty should be dropped, and the machine sold for Rupees 150, which would give the inventor a good profit.

his batten table. It is now so well known, and in such general use, that I shall describe it very shortly. It is nothing more than a low chest-of-drawers, or trays fitted in a frame one above the other, the bottom of each tray being fine iron wire, so that the heat from the charcoal, in the masonry receptacle over which it is placed, ascends through all the drawers and thus dries or fires a large quantity of "roll" at the same time. By the old plan, a single wicker sieve was inserted inside a bamboo frame, called a "dhole," which was placed over a charcoal fire made in a hole in the ground. On the sieve, the roll was placed, and all the heat after passing through this *one* sieve was wasted. Mr. McMeekin's idea was to economize this heat, by passing it through several drawers.

Most planters use these drawers, and there is no doubt in the space saved, and the economy of heat, it is a great step in advance over the old barbarous method, where not only was the heat wasted after passing through *one* sieve, but a great deal was lost through the basket work of the "dhole" itself.

Still I do not advocate four still less five drawers one above the other. I think the steam ascending from the lower drawers, must, more or less, injure the roll in the upper ones. I confine myself to two, and even then in the top tray, leave a small circular space vacant by which the steam from the lower drawer can escape. I utilize the heat that escapes, partially, by placing "dhallas" in tiers above, with roll in them. These are supported by iron rods let into the wall and are useful, not only for partly drying the roll, but also for withering leaf when there is no sun.

Mr. Dickinson has patented another invention, having for its object to do away with charcoal altogether under McMeekin's drawers, supplying its place by a current of hot-air generated in a furnace, outside the building, and driven under the said drawers, by a revolving fan worked

by animal power. The first point, in considering this invention is the question whether the fumes of charcoal, as some assert, *are* necessary to make good tea. If they are *not* necessary (that is, if they produce no chemical effect on the tea, and therefore heat from wood, devoid of smoke would do as well) there can be no doubt such heat would be cheaper, and more under command, by this or some other plan. Are then the fumes of charcoal necessary?

I do not know that any one can answer the query. *I* certainly cannot, for I have never made tea with any other agent than charcoal, and I have never met with more than one planter who had. *He* said the tea was not good. Still it would I think require very careful and prolonged experiments, to establish the fact either way. Speaking theoretically, as it *appears*, the only effect of charcoal is to drive all the moisture out of the roll, and thus make it tea, I cannot but believe other heat would do as well. It is however a question that only experience can solve.

Supposing hot air generated by any fuel to do as well as charcoal, I see no necessity whatever for a fan or any power. The natural draft, common to all furnaces, is the only power I would apply. I would make a sunken furnace on a grating (so that the draft would come up from below) at one end of the Dhole-house, and the chimney at the other. The communication between them would be by a 10-inch wrought iron pipe, which would be laid along the floor of the Dhole-house, to the foot of the chimney. It might twist and turn so that it would pass under each and every dhole.

The longer the pipe, and the higher the chimney, the more draft there would be. The heat from this pipe passing along under the drawers in each masonry dhole, would give any amount of hot air to dry the Roll. The heat would be commanded by "dampers" placed in the chimney, and between the dholes, for to shut off the draft to decrease the heat, it would be only necessary to close, or partly close, any of these. The

heat might at any time be increased by adding fuel to the furnace. It would thus be perfectly at command.

By this plan, no fan or motive-power would be necessary, and after it was all laid down, at an outside cost of say Rs. 300 for a large Dholing-house, the only after expenditure would be the wood for fuel, which is much cheaper of course than charcoal.

If the fumes of charcoal are *not* necessary, there can be no doubt the above plan would answer. It is only adopting for Tea, what is done in many manufactories for other things. I or rather my assistant did, carry out the plan in a Withering house (see later) and as far as the draft and heat generated in the house goes, it is a perfect success.

There is a machine for sifting and fanning tea at one and the same time. I know not who invented it. It is a simple winnowing machine with sieves placed in front of the fan. By means of a rod and crank attached to the axle of the revolving fan, the sieves are made to shake from side to side when the fanners are turned. The tea is put into the upper sieve, a coarse one, and passing successively through finer ones, is thus sorted into different teas. The open leaf at the same time is blown out by the fan.

I purchased one, but I do not find it does the work well. Sifting tea is a nice process, and I did not find it sorted the teas with any nicety. I have taken out the sieves, and use it now only for fanning, which it does very well, though no better than an apparatus which could be constructed at one-third the cost.

I do not believe in *any* present or future machine, for sifting tea, inasmuch as it is an operation, which to be well done, has to be continually varied. More will be said on this head further on.

I have now detailed shortly all the tea machines or contrivances, I know, or have heard of, and in my opinion, with the exception of McMeekin's drawers, tea manufacture has

not been much benefited by any. I must however except also Kinmond's Rolling machine, for this, as stated, is very useful to partially roll-leaf, but in my opinion it must be *finished* by the hand. There is plenty of room yet for inventors. The machine, as before observed most to be desired, is one to separate the small Pekoe leaves from the others, ere the rolling of the leaf is commenced. If such a machine existed, it would much increase the value of all Indian teas, and if the Agricultural and Horticultural Society are inclined to offer a prize for any machine, it should be this.

At the point, where the separation should take place, the stalk is much tenderer than elsewhere, and this led me to think a blow, or concussion, on the mass of green leaf might effect the object. I attached a bow by the centre, to an immoveable board, placed at right angles to the plane of a table (like the back of a dressing table) and then, causing leaf to drop from above, subjected it to sharp strokes from the string of the bow. It effected the object partially, for many Pekoe ends were detached, but it bruised and cut the other leaf too much also. I believe a revolving barrel, with blunt, but thin narrow iron plates inside, which would strike the leaf placed within, as the barrel was turned, would perhaps answer. I give the above idea for what it is worth, for any inventive genius to improve on.

As it is impossible, as far as I can see, to construct any machine, which should *cut* the stalk *only* in the right place, *ergo,* I believe some arrangement which would take advantage of the fact, that the stalk is tenderer there than elsewhere, is the only one that could answer.

Now to return to the manufacture of tea. I will consider each of the five operations detailed, which I believe are all that are necessary to make good tea, separately.

Withering.—There are several tests to show when leaf is withered. Fresh leaf squeezed in the hand, held near the ear, crackles, but no sound should be heard from withered leaf.

Again fresh leaf, pressed together in the palm of the hand, when released, springs back to nearly its original bulk, but withered leaf, in like circumstances, retains the shape into which it has been pressed. The stalk of withered leaf will bend double, without breaking, but fresh leaf stalks, if bent very little, break. Practice though soon gives a test superior to all these, *viz.*, the feel of the leaf. Properly withered leaves are like old rags to lay hold of, and no further test after a time, than the feel of the leaf is necessary.

The agents for withering leaf are sun, light, heat, and air. Of these the most powerful is sun, for it combines all the others with it. Light is a powerful agent, for if some leaf be placed in a partially dark room, and some in a well-lighted verandah, the latter will wither in half the time the former will take. If light and moderate ventilation be present, heat is a great accessary to rapid withering.

There is often great difficulty in withering leaf in the rains. It *can* be withered in tea pans, but "the out-turn" is then more or less injured, for after infusion, the out-turn comes out green, instead of the proper "new penny" colour. Withering in dholes is also objectionable for the same reason, though if the heat is moderate the green effect is less. It is further a long and tedious operation.

Space and light are the great wants for withering leaf in wet weather. Bamboo mechans, tier above tier, should be constructed in every available space. Large frames, covered with canvas, may also be made (by means of weights running over pulleys) to run up to the roof of any tea building. The leaf withers well in such frames, for heat ascends, and much heat is given out by dholes.

It signifies not though where leaf is spread, as long as there is space and light. But the best plan of all, for wet weather, is a house constructed expressly for withering. This should be well lighted with glass (best by a sky-light) with

a furnace outside, at one end, and a chimney at the other, (as already shown might be done for dholing) for by means of the communicating pipe, or pipes, any amount of heat can be got up in it, to wither leaf quickly in wet weather.

In dry weather, when leaf comes in from the garden, spread it thinly any where and turn it once early in the night. It will generally be withered and ready to roll next morning. If not quite ready then, put it outside in the sun. Half an hour's sunning will probably finish it.

In wet weather, if there is any sun when it comes in, or any time that day, take advantage of the sun to wither the leaf *partly*, so much that, with the after withering all night under cover, it will be ready next morning. If not ready next morning, put it out in the sun, if there is any, till it *is* ready.

In very wet and cloudy weather, when there is no sun and continual rain, so that the leaf *cannot* be put outside (for remember outside, when there is no sun, the light alone will wither it) artificial withering of some kind must be resorted to. I have mentioned the only means I know of for doing this.

As properly withered leaf is an important point in making good tea, it is well worth while to keep one or two men, according to the quantity of leaf, for that work alone. They soon learn the best way to do it, and if made answerable the leaf is properly ready for the Rollers, the object is generally attained. In this and every thing else in tea manufacture, give different men different departments, and make them answerable. Much trouble to the manager, who should supervise all, and much loss to the proprietor from bad tea, will then be avoided.

Rolling.—This is a simple operation enough, when the men have got the knack of it. Some planters advocate a circular motion of the hands, when rolling, under the impression it gives the leaf a better twist. Some like rolling it forward,

but bringing it back without letting it turn during the backward motion. I believe in neither way, for it appears to me to be rolled no better, or no worse, by these plans than by the ordinary and quicker mode of simply rolling it *any way*. The forward and backward motion is the simplest and quickest, and the way all rollers adopt, who are given a certain quantity of leaf (say 30 lbs., a fair amount) to roll for their day's work. In this ordinary rolling the ball in the hands, 'tis true, does not turn much in the backward motion, for 'tis more or less *pulled* back, but whether it turns or not, does not, I believe, signify the least.

Rolling in hot pans was formerly extensively practised. It is not much done now. I have tried the plan, but found no advantage in it.

Rolling on coarse mats, placed on the floor, might be seen also. When, I visited the Assam Company's gardens, near Nazerah in Assam, I saw it done there. It is a great mistake. The coarse bamboo mat breaks the leaf sadly, and much of the sap or juice from the leaf, which adds much to the strength of the tea, runs through the coarse mat, and is lost.

One and the principal reason why Indian tea is stronger than China is that in India the juice or sap is generally retained, while in China it is purposely wasted.

A strong unmoveable smooth table, with the planks of which it is formed well joined together, so that no apertures exist for the juice of the leaf to run through, is the best thing to roll on. If covered with a fine seetul pattie mat, nailed down over the edges of the table, a still greater security is given against the loss of any sap, and I believe the slightly rough surface of the mat, enables the leaf to roll better. An edging of wood one inch above the surface of the table, should be screwed on to the edges over the mat, if there is one, to prevent leaf falling off.

The leaf is rolled by a line of men, on each side of such a table (four-and-a-half feet is a good width for it) passing up

from man to man, from the bottom of the table to the top. The passage of each handful of roll, from man to man, is regulated by the man at the end, who, when the roll in his hand is ready, that is rolled enough, forms it into a tight compressed ball, (a truncated shape is the most convenient) and puts it away on any adjacent stand. When he does this, the roll each man has passes up one step.

The roll is ready to make up into a ball, when it is in a soft *mashy* state, and when in the act of rolling, it gives out juice freely. None of this juice must be lost, it must be mopped up into the roll, again and again in its passage up the table, and finally into the ball, when made up.

There will be some coarse leaves in the roll, which cannot be twisted. These, if left, would give much red leaf in the tea. They should be picked out, by, say, the third or fourth man from the head of the table, for it is only when the leaf has been partly rolled that they show. The man who picks out the coarse leaf should not roll at all. He should spread the roll, and pick out as much as he can, between the time of receiving and passing it on. In no case allow roll to accumulate by him, for if so kept it hardens and dries, and gives extra work to the last rollers to bring it into the mashy state again. Besides which, I rather think, any such lengthened stoppage in the rolling helps to destroy Pekoe ends, and is certainly injurious to the perfect after-fermentation, inasmuch as it, the fermentation, partly takes place then.

This finishes the rolling process. Each man as stated can do 30 lbs., but there is further work for him, to be now described.

Fermenting.—The balls accumulated are allowed to stand until fermented. I look on this being done to the right extent, and no more, as perhaps the most important point in the whole manufacture.

Some planters collect the roll, after rolling, in a basket, and there let it ferment, instead of making it up into balls, for that

purpose as described. I much prefer the ball system for the following reasons. When a quantity is put into a basket together and allowed to ferment a certain time, what was put in first is naturally more fermented than what was put in last, the former probably over, the latter under-done. The balls on the contrary can be each taken in succession *in the order they were laid on the table,* and thus each receive the same amount of fermentation. I think further the twist in the leaf is better preserved by the ball plan, and also that a large quantity in a basket, is apt to ferment too much in the centre.

It is impossible to describe, so that practical use shall be made of it, *when* the balls are sufficiently fermented. The outside of the ball is no good criterion. It. varies much in colour, effected by the extent the leaf was withered.* You must judge by the inside.

Perhaps as good a rule as any, is that half the twisted leaves inside shall be a rusty red; half of them green. Practice alone, however, will enable you to pronounce when the balls are properly fermented. There is no time to be fixed for it. The process is quicker in warm, than cool weather.

The fermentation should be stopped, in *each* ball, just at the right time. Great exactitude in this is all important, and therefore, as I say, the balls should be taken in rotation, as they were laid down.

The fermentation is stopped by breaking up the ball. The roll is spread out *very* thin, and at the same time, any remaining coarse leaves are picked out.

This concludes the fermenting process.

Sunning.—The roll is then without *any* delay put out in the sun, spread *very* thin, on dhallas or mats. When it has

* The more the leaf is withered, the thicker in consistency and the smaller in quantity, the juice that exudes, as also the yellower in colour. Further, the more the leaf is withered, the darker the outside of the balls. Bright rusty red is the colour produced with moderately withered leaf. Very dark greenish red with much withered leaf.

become blackish in colour, it is collected and re-spread, so that the whole of it shall be effected by the sun. With bright sunshine an hour, or even less, suns it sufficiently. It is then at once placed in the dholes, which must be all ready to receive it.

If the weather is cloudy, it may, nay should, nevertheless be put outside. The mere daylight helps to dry it, but it must in this case be kept out longer.

If the weather is wet, it must *directly*, the balls are broken up, and the coarse leaf is picked out, be sent to the dholes. This is the only plan in wet weather, but the best tea is made in fine weather.

Firing or Dholing.—In the case of wet weather, unless you have very many dholes, fresh roll will come in long before the first is finished. The only plan in this case is to half do it. Half-fired, the roll does not injure with *any* delay, but even half an hour's delay, between breaking up the balls and commencing to drive off the moisture, is hurtful.

In any but wet weather necessitating it, the roll can be fired at one time, that is not removed from the drawer, until it has become tea.

The roll in each drawer, must be shaken up and re-spread, two or three times, in the process of firing. The drawer must be taken off the fire to do this, or some of the roll would fall through into the fire, and the smoke thus engendered would be hurtful. If the lowest drawer is made to slide in and out, a frame-work covered with zinc, should be made to run into a groove below it, and this zinc protector should be always run in, before the lower drawer is moved. This is part of Mr. McMeekin's invention, and is very necessary to prevent roll from the lowest drawer falling into the fire when it, the lower drawer, is moved.

The roll remains in the drawers, subject to the heat of the charcoal below, until it is quite dry and crisp. Any piece then taken between the fingers should break with the slightest

attempt to bend it.

The manufacture is now completed. The roll has become tea.

All the above operations should be carefully conducted, but I believe the secret of good tea consists simply in first stopping the fermentation at the right moment, and *secondly*, in commencing to drive off the moisture immediately after.

I do not say that the manufacture here detailed may not be improved upon later, but, I do say that in the results of economy, strong liquor, and well-twisted leaf, its results are very satisfactory, and not surpassed by any other mode at present in vogue. I do not pretend that it will give teas rich in Pekoe tips. To attain this light rolling, as shown, must be resorted to, but just as far as Pekoe tips are procured, so far must strength be sacrificed. Until the small Pekoe leaves can be detached, and manufactured separately, this must always be the case.

From the tea made, as described, by sifting and sorting, all the ordinary black teas of commerce as detailed in Chapter XXV. can be produced excepting " Flowery Pekoe."

To make Flowery Pekoe the closed bud, and the one open leaf of the shoot are alone taken, and these are manufactured alone. It does not, as a rule, pay to make this tea at all, though it fetches a long price. It does not pay for the following reasons:

1. After the head of the flush is taken, the pickers that follow do not readily recognize the remainder of the shoot, and consequently omit to pick many of them. A heavy loss in the yield is thus entailed.

2. The after teas, made without these small leaves, are very inferior, as they are much weaker, and totally devoid of Pekoe tips.

3. The labour, and *ergo* the expence of picking the flush, is double.

I have never made Flowery Pekoe, and would rather

therefore not advise in its manufactures, for the little I know on the subject is merely what I have read, or been told.

Green Tea.—This also I have never made, and know nothing about it. The China plant is I am told, and believe the best suited to it. If so, it would probably be the best tea to manufacture in the North-West, especially as the black tea of those parts can not vie with Eastern Bengal produce. The market for it is not large, but neither would the quantity manufactured in the North-West be so.

Though I cannot advise myself, as to the manufacture of these two last teas, I am glad I can give the following directions regarding them from a "Prize Essay on the cultivation and manufacture of tea" by Mr. H. A. Shipp. The prize for the Essay, from which the following is an extract, was given by the Agricultural and Horticultural Society of India.

As I have nothing more to say of manufacture, the following extract will conclude this chapter:

Flowery Pekoe.

Flowery Pekoe is manufactured quite differently to the above teas, being submitted to neither the rolling nor roasting processes. When the leaves (to be plucked as described in a preceding paragraph), from which this class of tea is made, are brought to the factory, they are thinly spread upon mats and exposed to the influence of the sun for twenty minutes; after which they are cooled in the shade and again exposed to the sun in larger quantities, until the leaf has well shrivelled, when it is thinly sprinkled into flat sieves and placed over slow charcoal fires in the "choolhas" above mentioned, being at the same time covered up to keep in the aroma. Prior to being finally packed, this tea must be placed to a depth of five or six inches in each sieve or tray and thoroughly dried which takes about eight hours. The leaf having been carefully plucked in the garden (as advised) by the "Pekoe-Gang," requires neither winnowing, sifting, sorting nor picking, but should be packed, while hot, as soon as it is ready, the flavour being thereby improved.

Mode of manufacturing green tea.

The manufacture of green tea is a very tedious and lengthy process, nor has it been much practised in Cachar, but the following is a brief description of the mode in which it is performed by the Chinese tea-makers employed there.

The young leaves are, as soon as gathered, taken to the factory and immediately spread out to cool, which occupies some considerable time. They are then put into the horizontal pans and submitted to a heat of 150° until perfectly soft and pliable, being kept constantly stirred to prevent their adhering to the sides of the pan, after which they are quickly rolled and made up into balls, in the same manner as black tea, and exposed to the sun on mats to dry, the juice being expressed from time to time by the hand. This takes three hours, and they are afterwards transferred to the pans, where they are again heated and constantly stirred until the leaves become perfectly crisp and dry, which will occupy several hours, as it is necessary to bring out the required colour by this process. The more juice that is extracted from the leaves the better will be the colour and flavour of the tea, and this might possibly be more effectually done by machinery than by the hand. The tea, being now ready for the packing-house, is submitted to the same processes, as before mentioned in the case of black teas, and classified into Twankay, Hyson, Imperial, and Gunpowder.

CHAPTER XXV.

Sifting and Sorting.

THIS is a very important item in the manufacture of tea. Careful and judicious sifting, as contrasted with the reverse, may make a difference of 4 or 5 annas a ℔ in the sale of teas.

I was shown some tea, quite lately, which as regards "liquor," was valued by the brokers at Rs. 1-3 per ℔. but the "tea" at only 14 annas! This was entirely owing to faulty sifting and sorting.

I don't believe in *any* machine for tea-sifting, simply because it is not a regular process. For example, you cannot say that, to make Pekoe, you must first use one sieve, then another, and so on. The sizes of sieves to be used, and the order in which they are to be used, will vary continually, as both are decided by varying causes, *viz.*, the comparative fineness or coarseness of the tea made daily, the greater or less presence of red leaf in it, and (because tea varies much during the season and gets coarse towards the end) by the time of the year. These points all necessitate changes in the sizes, and the order of the sieves.

'Tis true sieves might be changed in a machine as required, but the only machine that could even pretend to save labour, would be one in which all the sieves were arranged one below the other, and thus the tea would fall through each alternately, the motion being common to all. But this won't do for tea sifting. Judgment must be used to decide *the length of time* each sieve is to be shaken; further, with *how much motion*, it shall be shaken, &c., &c. But this is simply impossible with any machine, though all necessary to sift tea well.

The cost of tea-sifting by hand (see chapter XXVIII.) is not 8 annas per maund including picking out red leaf, which *must* be hand work. Good and bad sifting will affect the value 5 annas per lb. or Rs. 25 per maund!

With all parts of tea manufacture, it is well to employ the same men continually in each department, but above all, perhaps, should this be done in tea-sifting. A good sifter is a valuable man. He knows each kind of tea by name; he knows what sieves to use, and the order in which to use them for each tea; what the effect a larger, or smaller mesh, will have on each kind, &c., &c., &c. In fact, he knows much more of the *practical* part of sifting than his master can, though the latter is, probably, a better judge how far the teas are perfect when made.

Tea sieves are of two kinds, both round. One made of brass wire with wooden sides, 3½ inches high, the other cane, with bamboo sides, 1¼ inches high only. The latter are called "Chinese sieves," and though the brass ones are used in many places, there is no possible comparison between them, for the labour required in the use of the brass ones is much greater, and the results, as regards well-sorted tea, much better with the Chinese.

Both kinds are numbered according to the number of orifices in the mesh, contained in one linear inch. Thus a No. 6 sieve has 6 orifices to the inch in both; but in

the brass kind, a No. 6 has six orifices *including* the wire; in the China kind, the cane between each aperture is *not* included in the measure. Thus the orifice in a No. 6 China sieve is exactly $\frac{1}{6}$ of an inch square, but somewhat less in a brass sieve.

As I well know brass sieves cannot remain in favour after the others have been, only once tried, I shall confine my directions to the China kind.

I practise, and I advise, tea to be sifted daily. The tea made one day, sifted the day after, and in fact stored away in the bins ready sifted. I find it is more carefully done this way, for by the other plan a larger quantity being done at once, by several men, they cannot from want of practice be expert. But by the daily plan, one, two, or three men as necessary, can always be kept on the work, and consequently they learn, and do it well.

To sift, the following China sieves are required, and if daily sifting is resorted to, they will be found ample for any ordinary sized garden.

4 of No. 4	9 of No. 9
6 of No. 6	9 of No. 10
6 of No. 7	6 of No. 12

4 of No. 16

Besides these, three or four brass sieves of No. 7 size are required, on which the coarse teas can be broken, for the China sieves are too delicate for this rough work.

Previous to sifting, all red leaf should be picked out of the tea. This, as stated under the head of Manufacture, should be done twice before the "roll" is fired, but towards the end of the season, especially, some will still remain in the made tea, and this must be carefully separated.

From what I have said, it is evident that no rules can be laid down as to what sieves to employ, to get out certain teas. Only practice can teach this.

Further practice can only enable you to judge of different classes of tea. This essay would, however, be incomplete, did it not contain a description of these. Such a description has been ably given by Mr. J. H. Haworth in his "Information and advice for the tea planter from the English market," *(Journal, A. & H. Society of India, vol. XIV.,)* and, as his knowledge on the subject is far in advance of mine, and consequently more to the point than any description I could give, I will close this chapter with the following extract from his valuable pamphlet, and trust he will excuse my doing so:

Of the different classes of Tea.

Teas are arranged in various classes according to the size, make, and color of the leaf. I treat first and principally of the Black descriptions, as Green Teas are manufactured in only a few of the Tea-growing districts of India.

The following classes come under the name of Black Tea:—

Flowery Pekoe.	The various broken kinds	Broken Pekoe.
Orange Pekoe.		Pekoe Dust.
Pekoe.		Broken mixed Tea.
Pekoe Souchong.		Broken Souchong.
Souchong.		Broken Leaf.
Congou.		Fannings.
Bohea.		Dust.

We occasionally meet with other names, but they are generally original, and ought not to be encouraged, as a few simple terms like the above are sufficiently comprehensive to describe all classes manufactured.

Perhaps before entering into a detailed description of the various classes it will be well to explain the term "Pekoe" (pronounced Pek-oh,) which, as we see, occurs in so many of the names above quoted. It is said to be derived from the Chinese words "Pak Ho" which are said to signify white down. The raw material constituting Pekoe when manufactured, is the young bud just shooting forth, or the young leaf just expanded, which on minute examination will be found to be covered with a whitish velvety down. On firing these young leaves, the down simply undergoes a slight change in color to grey or greyish yellow, sometimes as far as a yellowish orange tint.

When the prepared tea consists entirely of greyish or greenish greyish Pekoe, with no or very little dark leaf mixed, it is called Flowery Pekoe.

Flowery Pekoe is picked from the shrub entirely separate from the other descriptions of tea, only the buds and young leaves being taken. In the preparation it is not subjected so severely to the action of heat as the other classes of tea, and generally preserves a uniform greenish grey or silvery grey tint. Its strength in liquor is very great, flavor more approaching that of green teas, but infinitely superior, having the strength and astringency without the bitterness of the green descriptions. The liquor is pale, similar to that of a green tea, and the infused leaf is of a uniform green hue. In many instances where too much heat has been employed we find dark leaves intermixed, and the prevailing color, green, is sprinkled with leaves of a salmony brown tinge which is the proper color for the out-turn of any other ordinary black leaf tea. A very common mistake is to call an ordinary Pekoe that may contain an extra amount of Pekoe ends, Flowery Pekoe. When this class of tea is strong and of Flowery Pekoe flavor, it is called by the trade a Pekoe of Flowery Pekoe kind. In England Flowery Pekoe sells, as a rule, from 4*s.* 6*d.* to 6*s.* 6*d.* per lb. One parcel has sold as high as 7*s.* 6*d.*

By many people the expediency of making Flowery Pekoe is much doubted. The true Flowery Pekoe leaf is the one undeveloped bud at the end of each twig. To pick this alone, without any ordinary Pekoe leaves, involves a great deal of trouble and expense, and I think, though the Flowery Pekoe be very valuable, that the account would hardly balance when we consider the deterioration of the Pekoe by the abstraction of the young leaves.

An ordinary Pekoe is a tea of blackish or greyish blackish aspect, but dotted over with greyish or yellowish leaves which, on close inspection, will be found to possess the downy appearance which gives the name to Pekoe. In general we do not find the whole leaf covered with down, but only part of it, which, in its growth has been developed later than the other parts. These are called by the trade "Pekoe ends," when very small Pekoe tips. A Pekoe is generally of good to fine flavour, and very strong, and its liquor dark. Its value is from 2*s.* 9*d.* to 3*s.* 8*d.* per lb.

When the Pekoe ends are of yellowish or orange hue, and the leaf is very small and even, the tea is called Orange Pekoe. In flavour it is much the same as an ordinary Pekoe, and many growers do not separate the two varieties, but send them away in the finished state mixed together. Its value is from 2*d.* to 4*d.* per lb more than Pekoe.

The term Pekoe Souchong is generally applied to a Pekoe that is deficient in Pekoe ends or to a bold, Souchong class leaf,

with a few ends mixed. We often meet with it applied to an unassorted tea, including perhaps Souchong, Congou, a few Pekoe ends, and some broken leaf. Prices range from 2*s.* 3*d.* to 2*s.* 10*d.*

The name of Broken Pekoe indicates at once what class of tea it is, namely, Pekoe which has been broken in the manipulation or otherwise. It possesses the strength and fine flavour of a full leaf Pekoe, being therefore only inferior to it in point of leaf. In value it is very little inferior to Pekoe, sometimes as valuable, or even more so, as owing to the frangibility of the tender Pekoe ends, they are sometimes broken off in very large quantity, thus adding to the value of the broken tea, though at the same time deteriorating the Pekoe. Prices from 2*s.* 6*d.* to 3*s.* 4*d.*

Pekoe dust is again still smaller broken, so small in fact as actually to resemble dust. It is of great strength though often not pure in flavour, as frequently any dust or sweepings from other tea is mixed with it to make the lot larger. The price of Pekoe dust may range from 1*s.* 6*d.* to 2*s.* 8*d.*

A tea only slightly broken is often called by the planter Pekoe dust; again an orange Pekoe is often called Broken Pekoe, and the converse. A knowledge of the signification of these and other terms would teach the grower to be very careful in marking his teas, as the nomenclature influences to a great extent the sale in the home market.

Having described the finer teas we now come to the consideration of the classes of tea which form the bulk of the manufacture of a garden.

Souchong may be taken as the medium quality, and when experience and skilled labor are employed in the manufacture, as the bulk of the produce of an estate. The qualifications for being comprehended under this term are just simply an even, straight, or slightly curled leaf, in length varying say from half an inch to one and-a-half inch. It has not the deep strength of Pekoe, but is generally of good flavour, and of fair strength. The prices of Souchong are from 1*s.* 10*d.* to 2*s.* 8*d.*

Congou comes next. It may be either a leaf of Souchong kind, but too large to come under that class, or though of smallish sized leaf, too unevenly made, or too much curled (so as to resemble little balls,) to be so classified. The flavor is much the same as that of Souchong, but the tea has not so much strength. Some of the lower and large leaf kinds may be only worth perhaps from 1*s.* 3*d.* to 1*s.* 6*d.* whereas the finer qualities sell as high as 2*s.* to 2*s.* 3*d.* *per* lb.

Bohea is again lower than a Congou. It may be either of too large a leaf to be called Congou, or, as is generally the case, it may consist principally of old leaf, which, on being fired, does not attain the greyish blackish colour which is so desirable for all the black leaf kinds except Flowery Pekoe, but remains

of a brownish, or even pale yellowish hue. It has scarcely any strength, and is generally of coarse flavor, sometimes not, but is never of much value unless of *Namuna* kind (a term which will be described hereafter.) We may quote prices at from 3*d.* to 1*s.* 2*d.* per lb.

We now come to the broken descriptions of these middle and lower classes of tea.

Broken mixed tea is, as its name imports, a mixture of the various kinds of tea broken. It may have a very wide range, include some of the lower classes or approach Broken Pekoe in character and value, but the kind usually thus named is a tea worth from 1*s.* 8*d.* to 2*s.* 6*d.* generally of a blackish aspect, and containing a few Pekoe ends.

The term Broken Souchong is commonly and appropriately applied to a tea, which, though broken, has some approach to a full leaf, and that of the even Souchong character. Its value may vary, say from 1*s.* 6*d.* to 2*s.* 2*d.*

Broken leaf is a term of great comprehensiveness, but generally is used to signify a tea worth from 8*d.* to 1*s.* 1*d.* *per* lb. It may be of a brownish, brownish blackish or blackish color. Its strength is seldom great, but its flavour may be fair or good, but in the lower qualities it is generally poor, thin, or coarse. It would be better to employ this term only as a general name of Broken Tea, and not to use it to signify any particular class, as it is very indefinite.

Fannings is similar in color and class of leaf to Broken Leaf as described above; in value also much the same, perhaps on the average a little lower. I suppose, in most cases, the mode of its separation from the other classes of tea is, as its name implies, by fanning.

Dust is a very small broken tea, so small in fact as to approach the minuteness of actual dust. It is often very coarse, or "earthy" in flavor, owing perhaps to sweepings and dust having become mixed with it. Its value is from 6*d.* to 1*s.* 6*d.* In any tea of this class worth more than these quotations, a few Pekoe ends or tips will generally be found, which bring it under the name of Pekoe Dust.

We will now look at Black Teas in a body and point out what is desirable and what is objectionable in them.

We have seen that all teas which contain Pekoe fetch higher prices than others, consequently we infer that Pekoe is a desideratum. If we glance at the descriptions of the various classes of tea which have been given above, we shall find that it is an element of strength and good flavor. I do not mean to say that any Pekoe is stronger or of better flavor than any tea which does not contain Pekoe, as the soil, the climate, the cultivation, the manufacture and various other causes, may influence the strength and flavor of different teas; but as a rule, in teas that are produced under the same circumstances, the classes

containing Pekoe are stronger and of better flavor than those without it.

There is another class of tea which I have not yet described, that possesses very great strength and very fine flavor. This is the class known as the "Namuna kind." All readers of these pages who have been connected with India any time will recognise the word * though they may not quite see how it comes to occupy the position in which we consider it. It is said that its first application in this manner arose from a planter having sent to England some sample boxes of tea with the ticket "namuna" on them. These teas happened to be of the peculiar description which now goes by that name, and which I proceed to describe. The London Brokers have always since then applied the name namuna to this class of tea. The leaf may have perhaps the ordinary greyish blackish aspect with generally a greenish tinge. In the pot it produces a very pale liquor, but on tasting it, its quality belies the poor thin appearance of the infusion. It is very strong, stronger by far than ordinary pekoe; in flavor say about half way between a flowery pekoe and a green tea, quite distinct from the flowery pekoe flavor, possessing somewhat of the rasping bitterness of the green tea class with the flavor a little refined. The out-turn is generally green, sometimes has some brownish leaves mixed. Any of the black leaf teas may be of this class, from the Pekoe to the lowest Dust, and all throughout the scale, if the flavor be distinct and pure, may have their value enhanced from 4*d.* to 10*d.* per lb.

Similar in every respect except one is the Oolong kind. The one wanting quality is the strength, sometimes, by the bye, the flavor is a little different. It may have the greenish greyish blackish leaf (though generally the green leaves are distinct from black ones the tea thus being composed of greyish, blackish leaves with a few green ones intermixed), always has the pale liquor, generally the greenish infused leaf, but sometimes it is sadly intermingled with black leaves, as it is a tea whose flavor is frequently burnt out, though its weakness and green appearance are no doubt often caused by deficient firing. Teas of this kind on the average sell below the ordinarily-flavored teas of the same class of leaf.

In teas of ordinary flavor the following rules hold good:—The darker the liquor the stronger the tea, and the nearer the approach of the color of the infused leaf to a uniform salmony brown, the purer the flavor. Whenever we see any black leaves mixed with it (the out-turn,) the tea has been overfired, and we may either expect to find the strength

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* I need hardly remark that the Hindustani word Namuna, (pronounced Nemoonah) means sample.

burnt out of it, or else to find it marred by having a burnt or smoky flavor incorporated with it. When you come across an altogether black or dirty dark brown out-turn, you may be certain of pale liquor containing little or no strength and no flavor to speak of, unless sometimes it be sour. This is a quality which I shall now touch upon, and regret that I cannot with any certainty give any reliable information whereby the planter may guard against this greatest of faults. It may have various grades,—slightly sourish, sourish, and sour, depreciating the value of the tea say from 3*d*. to 1*s*. 6*d*. per ℔. The flavor of a sour tea is hardly capable of description. It is not so acid as sour milk, in fact not acid at all, rather a sweet flavor than otherwise being blended with the sourness. It is extremely unpleasant in its more developed grades, and cannot be easily understood except by actual tasting. To the uninitiated this fault is only perceptible in the more strongly marked instances, but to one of the trade the least tendency to it not only condemns the parcel at once, but also causes him to suspect any other lots made at the same or any other time, by the same grower; as it is a curious but unaccountable fact that some two or three gardens (or growers?) almost always produce teas having this fault. I will not cite all the different explanations that have been offered on this subject; I will simply quote the one which seems to have gained most ground and leave those more competent than myself to express any opinion on the subject. The cause assigned, to which I refer is, that the tea leaf after being picked is allowed to remain too long in the raw state before being fired, during which time it undergoes a process of fermentation; some, then, say that this causes sourness, while others maintain that the fermentation is absolutely necessary for the production of a black tea. The fact that we never meet with sourness in a green tea, one feature in the preparation of which being that it is fired almost immediately on being gathered, goes to corroborate this view.

Burntness I have already referred to. As I said before, it may either destroy the strength and flavor altogether or sometimes without destroying the strength, add an unpleasant burnt flavor to it. When the tea has the flavor of smoke about it, it is called smoky or smoky burnt. By being burnt a tea may be deteriorated in value say from 2*d*. to 1*s*. per ℔. The symptoms of burntness are a dead black leaf (as opposed to the greatly desired greyish blackish color) having a burnt smell which often entirely neutralizes the natural aroma of the tea. In looking over a broker's character of a parcel of teas you may occasionally meet with the terms "fresh burnt," "brisk burnt" or "malty burnt." These phrases do not carry a condemnatory meaning with them. The meaning of the word burnt as used here, would be better

expressed by the term fired. The term malty means of full rich flavor; perhaps from the aroma of this class of tea resembling somewhat that of malt. Teas of the three above descriptions you may have noticed, often fetch very good prices. The meaning of the word "full" applied to a liquor is hardly appreciable except by tasting. It does not signify strength nor flavor, but is opposed to thinness. A green tea may be strong or of good flavor, but its liquor is never full. Fulness is generally characterised by a dark liquor. The quality known as body in a wine is somewhat akin to fulness in a tea. We speak of a "full" leaf tea in contradistinction to a broken leaf. "Chaffy" is generally used in connection with Bohea and other brown leaf classes of tea. A light (in weight) brown, open or flat leaf, in fact one resembling chaff, would be called chaffy. The lower classes of tea, specially the dusts, are often described as "earthy" in flavor. By this a coarse low flavor is understood, perhaps often caused by the admixture of real dust.

When the make of a tea is spoken of, as a "well made," "fairly made," &c. leaf, the effect of the manipulation or rolling is referred to. We may have a "well-made even," or a "well-made mixed large and small" leaf. We may have a "straight" or "curled," or as the latter is generally expressed when applied to a large leaf tea, "twisted" leaf. It may be "flattish-made," indicating that though the leaf is not open it wears a flattish aspect, or it may be open, which betrays a want of sufficient or skilful manipulation. A "wiry" leaf is small, perfectly rolled, and very thin (in diameter) generally rather curled, so as, in fact, to resemble small pieces of bent wire. It will be seen at once that only the finer teas can have a wiry leaf, principally the Orange Pekoes and Pekoes. Sometimes we meet with a fine Souchong that may be thus described.

Green Teas.

As in the North-West provinces Green Teas form the bulk of the produce, it will be well to give a short description of them though the tenor of my remarks below will shew the general opinion as to the desirability of making them.*

Gunpowder is the most valuable description, its price ranging from 2*s.* 8*d.* to 3*s.* 8*d.* per ℔. Instead of possessing the long and thin finished leaf which is the desideratum of Black Teas, it is rolled into little balls more or less round, varying from one-eighth to one-quarter of an inch in diameter. Some-

* I think I need hardly pause to correct the popular error that the green and black Teas are made from two different species of plant. Most of my readers will know that they are both made from the same leaf, the difference lying only in the manufacture.

times it is not altogether composed of round leaf, but has some long leaf mixed.

When the Tea is of the shape of Gunpowder, but is larger than the size above quoted, it is called Imperial. Prices of Imperial are from 10*d.* to 2*s.* 6*d.*

Amongst Green Teas Hyson may be taken as the parallel of Souchong of the black leaf descriptions. Undoubtedly there is often much young Pekoe leaf in it, but all chance of *discriminating* it in the finished leaf is done away with by the change in color. Hysons sell from 1*s.* 2*d.* to 3*s.* 6*d.*

Young Hyson is smaller than Hyson, occasionally slightly broken. It fetches from 7*d.* to 2*s.* 6*d.*

Hyson skin consists of the bold broken leaf of Hyson and young Hyson. A small broken Green Tea is seldom sent to the home market. The reason of this is obvious. When we consider that Hyson Skin only fetches from 7*d.* to 1*s.* it is apparent that anything approaching a dust would give very little chance of a profit. I have seen one or two parcels too much broken to come under the title of Hyson skin, sell at 3*d.* to 6*d.* per ℔ in London. It would be well if some of the Indian planters would take a lesson from the Chinese, and not send home their very low teas, black or green, as they are very difficult of sale in London, and in many cases cannot pay the cost of packing and shipping. The Chinese make a great quantity of their broken teas into Brick Tea and send it into the central provinces of Asia, where it meets with a ready sale. I do not see why this should not be done by the Indian growers. There is a large consumption of tea on the other side of the Himalayas, not very far from Darjeeling and Assam. I hear also that in the neighbourhood of the growing districts, especially the north-west provinces, the natives are beginning to consume largely, and will pay 8 As. to 1 Rupee for a tea that could not possibly fetch more than 1*s.* to 1*s.* 6*d.* per ℔ in England. Whether the natives of India, as a whole, do or do not take to drinking tea, will have a material effect on the future prospects of the article.

Before dropping the subject of Green Teas, I will say a word or two as to the expediency of making Green Tea. I have questioned several experienced people on the subject, but none can tell me their especial object in manufacturing their leaf into green tea. One gentleman told me that he thought that it was because their tea-makers (Chinamen) knew better how to make greens than blacks. I have carefully examined the leaf of several of the north-west green teas, and noticing their English sale prices, consider that they would have sold on the average at least 3*d.* per ℔ higher had they been made into black Tea. The best way to test this would be to have green and a black tea made from the same leaf, and then to value the one against the other. I regret that I have never had the opportunity of doing this. We notice that the largest and most ex-

perienced producers never make green tea.

I must not pass over Caper without a short description. It is a tea which is made in large quantity in China, though I have only seen one parcel of Indian growth. It forms a link between the black and green descriptions. The color of the leaf is a very dark green, in form it is similar to a Gunpowder, Imperial or round leaf Congou. The liquor is pale and the out-turn green, flavor perhaps nearer to that of a green than of a black Tea.

CHAPTER XXVI.

Boxes, Packing.

By far the best tea boxes are the Teak ones made at Rangoon. The wood is impervious to insects of all kinds, even white-ants. Sawn by machinery, the pieces sent to compose each box, are very regular. The plank is half inch, and each chest made up measures inside 23 by 18 by 18½ inches, and necessarily outside 24 by 19 by 19½ inches. The inner cubical contents are 7,659 cubic inches, and this suffices for above one maund of fine, and under a maund of coarse teas.

Each box is composed of fourteen pieces, *viz.*, for the two long sides three each; for the two short sides, two each, two for the bottom, and two for the lid. By the arrangement of three pieces in the long sides, and two only in the short sides, the centre piece of each long side is attached to *both* the short end pieces, and thus great strength in the box is insured, there being no place where it can possibly separate at the joints.

These boxes are not made to "dovetail." Each piece (and they are sawn with mathematical regularity, as to length, breadth, and thickness) must be nailed to its neighbour. The best nails for this are the kind called "French Pins" 1¾ inches long.

The wood is sold at Rangoon in bundles, and could be landed in Calcutta for about Rs. 1-8 or 1-12 per box. The boxes need not be made up till shortly before they are wanted, and in this form, of compact bundles of short pieces, are very convenient for transport and stowage.

Of course in many districts these boxes are not procurable, and local ones must be made. If so, use hard wood, and make your boxes *about* the size given above, for small boxes add much to the cost of freight.

Let the planks be $\frac{5}{8}$th of an inch thick, for $\frac{1}{2}$ inch, that is $\frac{4}{8}$th inch boards are not strong enough, except they are of teak or any other very good wood.

Take care the joints of the several pieces, composing the sides and ends, do *not* coincide at the corners, for if they do, the box is very apt to come asunder:

The best way to arrange the pieces is as described in the Rangoon boxes above.

" A form" must be made on which the inner leaden case shall be constructed. That is, a well-made, smooth box, to fit *exactly* into the box you pack in. It must be some three inches higher than the interior of the original box, and have bars running across inside, for handles, to lift it up, and let the lead case slip off it, after it, (the lead case) is finished.

Solder your lead case, over your form, in the way to waste least lead. In the Rangoon boxes described, two large, two small sheets* and one piece 22 by 9 inches (let in between the two large sheets) suffices, and there is little or no waste.

The lead case ready, hold up the form by the inner rods, and let the case slide off. Put it at once into the packing box, taking care no nails protrude inside, or any thing else which will hurt it, and thus prepare all the boxes for the break of tea you are about to pack.

One great advantage the Rangoon boxes, and in fact all machine-sawn boxes, have, is their equal or nearly equal weight. Purchasers of teas, at the public auctions, require " the tare" of boxes to be as near the same weight as possible. If the tares differ much, say more than three lbs., the tea will be depreciated in value. It is well there should be *about* the same weight of tea in all the boxes, that contain any one kind,

* Large lead is 37 by 22 inches. Small lead 25 by 19 inches.

but this is not nearly so essential, as approximation in "the tares."

Your boxes all ready and lined with lead, choose a fine day for packing. Do this whether you finally dry the tea in the sun, or over the dholes; for even in the latter case, it is well to avoid a damp day.

But before you pack, you must bulk. That is you must mix all the tea, of any one kind, so intimately together, that samples taken out of any number of chests, shall agree exactly. This can be done, by turning out all the tea on a large cloth, placed on the floor, and turning it over and over. No two days teas are exactly alike, and you have perhaps a month (say Pekoes) to pack. It is therefore necessary to mix them well.

Though I know many planters think the fumes of charcoal necessary and beneficial for the last drying, I do not. I have tried both sun and charcoal for it, and no difference was perceptible. The former costs nothing, is more commodious, and I always employ it when possible. The sun cannot burn the teas, the charcoal, if the heat is too great, may.

Whether you use sun or charcoal put the tea hot into the boxes. The only object of the final drying is to drive off the moisture, which it will certainly, in a more or less degree have imbibed since its manufacture. Even the large zinc-lined bins, which should be fitted up in all tea stores, and in which the tea is placed after manufacture, will not entirely prevent damp, so in all cases a final drying is necessary.

Keep it in the sun, or over the charcoal, until it is hot throughout, hot enough to ensure all the moisture having been driven off. Then put into the box enough to about one-quarter fill it. Now let two men rock the box, over a half inch round iron bar, placed on the ground, until the tea has well settled. Then place a piece of carpet over the tea, the exact size of the box, and let a man stand inside and press it down a minute or two with his feet. Now fill up nearly another quarter, and press it again over the carpet as before.

Repeat this, putting less and less into the box each time, as you near the top, until it is quite full, but do not rock it the last two or three times at all. Only press it with the feet as described. No patent screw press, or any thing else, will pack the tea better or more closely than this plan, and when the men are practised at it, you will find there will not be a difference, of more than two or three lbs., in the teas of any one kind put into the boxes.

The box full, just even with the top, and well pressed down to the last, lay over the tea a piece of the silver paper, which is found inserted between each sheet in the lead boxes. This prevents any solder, or rosin, getting on the tea, when soldering the top. Now fit on the lead sheet top, solder, and nail on the wooden lid.

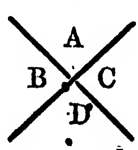
Weight tea in each box.—The boxes ready lined, with a lead cover, loose, must be all weighed *before* the tea is packed, and again *after* they are filled and soldered down, but *before* the wooden lid is put on. The difference of these weights, minus the weight of the little solder used in fastening down the top lead, (for which allow say one pound to give a margin also) will be the net weight of tea in each box.

Thin iron hooping, put round both ends of the boxes much increases their strength, and is not expensive.

Stamp each box on its lid, and on one end. Use for this zinc plates, with the necessary marks cut out in them. A brush run over these with the colouring matter does the work well and quickly.

Let the stamp comprize the kind of tea, the plantation or owner's mark, the number of the box, and the year, for instance.

Pekoe.



No. 80. 1871.

The invoice you send with the break must give for each box the number, the gross weight, the tare, the net tea, and the kind of tea ; with a declaration, at foot, that the teas of each kind have been respectively, well bulked and mixed together, before packing.

Remember, the larger the quantity of tea, of any one kind, to be sold at one auction, the higher the price it will probably fetch. Sell, if possible, twenty or thirty chests of one kind of tea at the same time, for small quantities, as a rule, sell below large, both in Calcutta and London.

CHAPTER XXVII.

Management. Accounts. Forms.

SYSTEM, and order, a good temper, firmness, attention to details, agricultural knowledge, industry, all these, combined with a thorough knowledge of tea cultivation, and tea manufacture, are the requisites for the successful management of a tea plantation.

To find men, with all these qualities, is, I allow, not very easy, still they do exist, and such a one must be had, if success in tea is looked for.

Before the work is given out each day, the manager should decide exactly what is most required, and apply it to that. He should write down, when distributing the men, the works and the number employed on each. This paper he should carry in his pocket, and he can then verify the men at work at each or any place, when he visits it during the day.

The writer, the moonshee, and the jemadar if there is one, should write similar papers when the coolies are mustered in the morning, and the manager should detail to each of these men, which work they are particularly resposible for. This should also be shown in the "morning paper."

Each of the above men then measure out the work to the coolies. Visit it once, or oftener, in the day, and measure

all that remains undone at night. A daily report of the work is kept, written by the writer in the evening.

The two forms, given below, are those I have adopted. The latter is suited to local labour paid daily, but it can easily be altered to suit either local labour paid monthly, or imported coolies.

This is the Morning Paper.

Work to be done on 187 .

Detail.	No of Garden.	In whose charge.	Head Man on the Work.	Probable Number.	Actual Number.
			Total Coolies	...	

The column of "probable numbers" is given, so that before it is known exactly how many men will be present for work, they can be divided in the most likely way.

Each head man (called "mate-mangee," &c., in different districts) is best designated by a letter or number. In neither form would there be room to put in names at length.

The form below written in the evening is made into a book for each month. The advantages of it for after refer-

ence are great, and it has many other advantages, too numerous to detail here, but which will be appreciated when it is used.

Work on *for* 187 .

Detail of Work.	No. of Garden.	Mangees.	Chupp.			Coolies.	Measurement and Remarks.
							As.
Total at work	...						× 3 =
Command	...						× $2\frac{1}{2}$ =
Sick	...						× 2 =
Absent	...						× $1\frac{1}{2}$ =
Total	...						× 1 =

Picking Leaf =

Making Tea =

Tea Sorting =

Cut =

Total =

The following is the plan I recommend for the leaf-picking, and the tea accounts.

The leaf of each picker is best measured in the field and as loads are collected, brought to the factory, by one or two men, throughout the day. It entails a loss of time, and further a depreciation in the leaf, if kept long in a close mass in one basket, each picker bringing his or her leaf to the factory twice a day. The pickers are paid so much per basket, holding in any case 2½lbs. I find the most convenient plan to give the mangée in charge of the pickers, tickets of any kind for this, which tickets are changed for money in the evening. As each load of leaf comes in through the day, it is weighed, and this gives a check on the tickets given by the mangee or mate. This is the meaning of the two columns in the form below " tickets by leaf" and " tickets paid."

In the form the first column of " leaf results" shows the condition of the leaf when picked whether wet (W) or dry (D). Unless this were noted, the proper amount of teas the leaf *ought* to make, could not be known, and there would be no check against theft which is carried on to a great extent in many gardens.

As explained previously, only the sections ready in each garden are picked. The sections are not entered in the form, only the number of the garden. The flushes now noted are the 20th, in some 21st, or 22nd in others.

The tea is calculated from the leaf. It should be 25 per cent. if the leaf is picked dry and 22 per cent. if picked wet. As each load comes in, a memorandum is made as to whether it is dry or wet, and the figures in the column " tea should be" are thus found.

The tea is weighed the morning after it is made and entered in the column " tea made." The percentage it bears to the leaf is then calculated and entered in the account column.

After sifting, the whole is weighed again, and the result entered in the column "tea after sifting." Doing this is very important, for it checks theft. Directly after it is weighed this second time, it is put in the bins in the store.

Daily Leaf and Tea Account.

Tea Results.					Leaf Results.							
Date.	Tea should be	Tea made.	Per cent.	Tea after it is sifted.	Stale leaf.	Tickets By leaf.	Tickets Paid.	Number of Garden.	Flushes 20	Flushes 21	Flushes 22	Total leaf.
								3	,,	170	,,	
October ..					220 W.			5	310	,,	,,	
Sunday 1st ..	,,	,,	,,	,,	600 D.	410	360	7	112	,,	,,	
								8	,,	,,	228	820
								3	,,	515	,,	
Monday 2nd ..	198	200	24	199	D.	462	440	9	410	,,	,,	925
								1	430	,,	,,	
Tuesday 3rd ..	231	230	25	233	W.	200	180	2	,,	,,	160	
								3	,,	210	,,	800
Wednesday 4th ..												
Thursday 5th ..												
Friday 6th ..												
Saturday 7th ..												
Total for the week	,,	Md. lbs. 16-32										

If this system is carried out, no tea (exceeding a lb or so) can be stolen, without its being at once missed, and the importance of this cannot be exaggerated. Tea proprietors do not guess *how* much is lost in this way. Maunds upon maunds might be stolen in many gardens, and unless the

theft were accidentally discovered, there is nothing in the Tea Accounts to show it to the manager.

I have suppositiously filled up the three first days of the form. The 820 lbs. leaf picked on Sunday is made into tea on Monday. The 198 is written down Sunday evening. On Tuesday morning, when the tea is weighed and found to be 200 lbs., that is entered in the Monday line as also the percentage. On Tuesday evening after it is sifted and made into different teas, it is weighed again, and found to be 199 lbs., and so entered.

In dry weather after sifting, owing to dust flying off, it is always a little less. In wet weather, on the contrary, it increases in weight. In the Tuesday line where "W" shows it was a wet day and the tea 230 lbs., before sifting, is 233 afterwards. This is owing to moisture imbibed, and it is the only objection to sifting daily, whatever the weather. The advantages of the plan though are so great, as explained, that I put up with this, and practically I do not find it detrimental. Of course, as previously explained, all moisture is driven off before the tea is *packed*. However, to make all quite safe, after a very wet damp day, the teas might be re-dried for a few minutes over charcoal before being put into their respective bins. I do not do this myself though, and do not think it necessary.

I hope now I have made the above form plain. It is in a book and each page will hold one week. The total of the tea made in the week is added up and shown at foot, and that amount is then transferred to the Credit Side of the Tea Store Account. Thus (see both forms) 16 maunds, 32 lbs. is credited.

The form given below is also kept in a book and the total of the right hand side, subtracted from the left, gives at any time the quantity of tea in store.

Tea Store Account.

Receipts.						Expenditure.							
Week ending on Saturday.		Tea made in week.		Total.		Date.		No. of Invoice.	To whom.	Tea in each Invoice.		Total.	
		Mds.	lbs.	Mds.	lbs.					Mds.	lbs.	Mds.	lbs.
Brought over ..	..	..	..	405	8				Brought over ..	..	..	351	14
October	7th	16	32			October	3	15	———	40	15		
,,	14th	15	0			,,	20	16	———	33	10	73	25
,,	21st	17	10										
,,	20th	14	40										
				63	2								
Carried over ..						Carried over ..							

Regarding Accounts between the manager and his employers, I think they should be of the simplest kind. If a man *can* be trusted, he *should* be trusted, if he cannot, no system of accounts will restrain him, and he should be kicked out. A simple Account Current, furnished monthly, showing under few heads, the receipts and expenditure, is all that can be required. It is not by *any* papers received from a manager, that an opinion can be expressed as to how he does his work, and how the plantation progresses. A competent person,

visiting the garden, can easily ascertain, and in default of this, and combined with this, the only test is the Balance Sheet at the end of each season.

Shortly, it is not, by the form, the nicety, the detail of accounts, between manager and employer, that success is insured or even forwarded. It is, as far as accounts are concerned, by the forms and *system* the manager adopts as between him and his subordinates, and these he should be able to show are good to the employer, or any one deputed by him, to visit the garden.

The profit shown yearly, whether it is large or small, all things considered, is however still the only true ultimate test.

CHAPTER XXVIII.

Cost of Manufacture, Packing, Transport, &c.

This is as follows:—It will vary more or less according to the site, rate of wages, &c., but in the form the tables are given, if not suitable to any case, it can easily be made so.

I have added Sorting, Packing, Freight to Calcutta, and Broker's Charges in Calcutta, to the cost, so that all is included, from the moment the green leaf is picked off the trees, till the hammer falls at the public auction.

Table cost of Manufacture, Sarting, Packing, Transport to Calcutta, and Broker's Charges for each maund of Tea.

	Rs.	As.	P.	Rs.	As.	P.
Manufacture.						
1 head man with the pickers, say	0	4	0			
320 lbs. green leaf picked, at 1 pice per lb. *	5	0	0			
1 man withering above leaf, at say 4 annas	0	4	0			
Carried over ...	5	8	0			

* In practice the basket in which the leaf is measured being made to hold 2½ lbs., for which a ticket is given, representing 2 pice, the leaf to make a maund of Tea does not really cost so much.

	Rs.	As.	P.	Rs.	As.	P.
Brought forward ...	5	8	0			
¼ share head man in Rolling-house	0	2	0			
10⅔ men rolling above, at 30 lbs. leaf per man, and say 4 annas per man	2	10	8			
¼ boy clearing out ashes of Dhole house, at say 2 annas ...	0	0	6			
¼ share head man in Dhole house	0	2	0			
1 man firing "Dhole work" say	0	4	0			
¾ maund charcoal for Dhole work, at 8 annas	0	6	0			
Lights for night work, *viz.*, turning green leaf and Dholing, say	0	4	0			
Wear and tear of dhallas, baskets, picking baskets, fuel for artificial withering, &c. ...	0	1	10			
				9	7	0
Sifting and Sorting.						
1½ boys to pick out red leaf, at say 2 annas	0	3	0			
1 sifting man, at say 4 annas ...	0	4	0			
Wear and tear of sieves, say ...	0	0	3			
				0	7	3
Packing.						
1 box	1	13	0			
4 sheets lead, *viz.*, 2 large and 2 small	1	6	6			
Labour of lining box with lead, solder, closing lead, closing wooden box, stamping, and cost of nails	0	0	9			
Carried over ...	3	4	3	9	14	3

	Rs.	As.	P.	Rs.	As.	P.
Brought forward ...	3	4	3	9	14	3
Labour of drying previous to packing, whether in sun, or over Dholes, including charcoal, if the latter are used ...	0	0	9			
Labour of filling the box, shaking it well, and pressing down the tea (2 men)	0	0	6			
				3	5	6
Transport.						
Freight to Calcutta for one maund tea, say	1	12	0			
				1	12	0
Broker's charges in Calcutta.						
Landing, lotting, and advertising per chest	0	14	0			
Brokerage at 1 per cent on the amount sale, say Rupees 70 for the maund	0	11	3			
				1	9	3
Total for one maund Tea ...				16	9	0

N. B.—If more than two maunds tea are made per day, some of the items under head of "Manufacture" would be a little less.

CHAPTER XXIX.

Cost, cultivating, and keeping in high cultivation, a made garden.

THIS is placed before the next Chapter, which details the cost of *making* a garden, because some of the results arrived at below will be required there, inasmuch as making a plantation includes not only *the making* it but also the keeping it up, until it pays its own way.

The plantation here supposed is a 100 acre one, and as previously stated, in my opinion no garden should be bigger.

The expenditure will be calculated per acre and of course any total shown, multiplied by 100, will give an estimate for the whole garden.

The garden is supposed a made one in *every* way, with all necessary buildings in good order. Further, no expenditure connected with manufacture is here shown, for that is given under its own head.

The expenditure given includes *only* the yearly estimated cost of *highly* cultivating one acre of such a garden, or such a whole garden, in a way that it shall give the largest yield, of which it is capable.

The rates of daily pay, calculated, may not accord with existing rates in some places, but the tables below can be made to apply anywhere, by altering the said rates.

It may seem to some, the estimate is a high one. If the item of manure, Rs. 31, is deducted, it is even within the estimates I have sometimes seen made. But whether high, or not, if a garden is to be kept up to give a really large yield and pay really well, it will not be done for less.

The work required and for which the following estimate is made is detailed in Chapter XVIII.

A null (see below) is 12 feet. All work is measured by "nulls" that is to say square nulls. The work is measured with bamboos 12 feet long. One acre equals 302½ nulls, but I omit the odd 2½, and calculate 300 nulls to one acre.

I omit pie, should there be any, in all the totals, as also any small fractions, anywhere, which would not sensibly effect the result :

Digging three times.

As each man, if the garden is kept in order, can dig 30 nulls, it follows

	Rs. As. P.	Rs. As. P.
then ten men can dig an acre once, or 30 men can dig it three times. One head man or sirdar can superintend 30 men, so ⅓ of a sirdar is wanted per acre each time, or one man for the three times.		
One head man	0 4 0	
30 coolies, at 3 annas	5 10 0	
		5 14 0
Digging round plants nine times.		
Say there are 2,500 plants to the acre, then doing it nine times, would give 22,500 plants to dig round. A big boy can do 400 per day, which gives 56 boys for the nine diggings, of one acre. More than 20 should not be put under one sirdar for this work, so we must calculate three head men.		
Three head men, at 4 annas ...	0 12 0	
56 boys, at 2 annas	7 0 0	
		7 12 0
Dutch hoeing six times.		
Forty-five nulls per man may be calculated for this, which equals 6¾ men per acre, or 40 men for one acre six times.		
1½ head men, at 4 annas ...	0 6 0	
40 men, at 3 annas	7 8 0	
		7 14 0
Pruning.		
To prune *well* a man cannot do more than 150 large trees. This gives 16⅔ men to the acre of 2,500 plants.		
Carried over		21 8 0

	Rs.	As.	P.	Rs.	As.	P.
Brought forward ...	......			21	8	0
One head man, at 4 annas ...	0	4	0			
16⅔ men, at 3 annas	3	2	0			
Manuring.				3	6	0
May be added. If unfortunately no expenditure can be incurred in this, it must be struck out from the total below. We will take the medium rate per acre set out in Chapter XIV.	31	0	0			
				31	0	0
Nurseries to fill up vacancies, and labour of filling them up.						
Four maunds seed to be sown which will be picked from the garden. Pots and baskets to be used as described (Chapter XXI.)						
Picking seed, say	2	8	0			
Making Nurseries, say	25	0	0			
Artificial shade, say	10	0	0			
Sowing, watering, weeding, and transplating the seedlings in the vacancies and tending them later, say	150	0	0			
10,000 pots and baskets, at 2 pice each	312	8	0			
				5	0	0
Total, cost ...	500*	0	0			
The calculation of expense being for one acre of a 100 acre garden, one hundredth of the above Rs. 500 is taken						
Carried over ...	......			60	14	0

* Rs. 500 spent in nurseries for filling up vacancies; and when once the garden is really full, *in substituting* high class plants for the China kind, would be a judicious expenditure on the best garden I have ever seen, for years to come.

	Rs. A. P.	Rs. As. P.
Brought forward	......	60 14 0
This closes the cultivation expenditure, but the Establishment to work all this, has now to be added :		
1 Manager at Rs. 250 per m.,	3,000 0 0	
1 Writer at " 25 "	300 0 0	
1 Moonshee at " 15 "	180 0 0	
1 Jemadar at " 12 "	144 0 0	
1 Tool Moonshee at " 10 "	120 0 0	
1 Chaprassee at " 6 "	72 0 0	42 2 0
Keep of one horse and servants, at Rs. 16 per mensem ...	192 0 0	
Miscellaneous say ...	200 0 0	
	4,208 0 0	
All men in charge of plantation work are calculated for above *in* those works, and all men employed on manufacture are calculated under that head. The total is again divided by 100 to bring out the cost per acre, giving as above ...	42 2 0	
Miscellaneous.		
New agricultural tools and repairs of tools yearly, say ...	200 0 0	
Repairs to building	400 0 0	
Fire insurance on buildings say* ...	100 0 0	
Margin for all other possible expenses not calculated, such as medicines, live stock† stationery, &c., &c. ...	1,000 0 0	17 0 0
Total ...	1,742 2 0	
Carried over ..	......	120 0 0

* All the buildings should be insured. They can be so, in more than one Office in Calcutta. *The Tea Store,* however, should be simply incombustible.

† I know of nothing beyond one horse that is necessary, but any number of cattle kept, will pay well, with their manure.

	Rs.	As.	P.	Rs.	As.	P.
Brought forward ...	......			120	0	0
Again divided by 100 for the expense per acre giving Rs. 17 as above.						
Total cost per acre per annum for keeping up well-made garden ...	......			120	0	0
Or *ergo,* 100 acre garden will cost per annum, 100 times the above, *viz.*..	......			12,000	0	0

An acre of tea may, I am aware, be kept up *in a manner* for Rs. 50 or so yearly, but the profit on such a plantation must be *nil.*

On the contrary, with the above expenditure per acre, on a good and favourably located garden, the profit will be very large.

It is with tea as with all other cultivation. It has been proved in England, and in all other countries, where really high cultivation is followed out, that the higher the system followed, the greater the profit. In the manner tea has been cultivated hitherto, profit could scarcely be looked for.

CHAPTER XXX.

Cost of making a 100 *acre Tea Garden.*

In the following estimate 40 acres is supposed to be planted the first, 40 acres the second, and 20 acres the third year.

To elucidate a table I shall draw up in the next chapter showing the probable receipts and expenditure on such a garden for a series of years, I shall suppose this plantation to be begun in 1871, and number the years accordingly.

The expenditure would truly, in the supposed case, begin in the latter part of 1870, but it is more convenient to regard it as commencing 1st January, 1871, and thus keep each year separate.

I shall not pretend, in this, to go into minute details, such as the last chapter contains, for it is simply impossible to do so. The cost of making a plantation must vary greatly, being determined by climate, available labour and its rates, lay of land, nature of jungle to clear, &c., &c. In this estimate only round numbers can be dealt with. The prices I assume are average ones, neither suited to very heavy jungle, and very expensive labour, or the reverse :

First year, (1871.)	Rs.	Rs.
Purchase of 400 acres land at 2-8 per acre ...	1,000	
First temporary buildings	500	
Tools	300	
20 maunds seed,* at Rs. 30 per maund ...	600	
Nursery	500	
Cutting and clearing jungle, removing roots, digging, staking, pitting, and transplanting, in fact all expenditure on 40 acres until the seedlings are planted, at Rs. 100 per acre	4,000	
Cultivating the 40 acres after they are planted in June, for the rest of the year	1,500	
Manager and Establishment, (see last chapter) †	4,000	
General expenses	1,000	
Total, 1st year's outlay ...	13,400	
Interest at 8 per cent. per annum on outlay for six months ...	536	
		13,936

* More than 8 or 10 maunds, seed, if really good would not be required; but a large margin in seed must always be given.

† Establishment is a trifle less than calculated in the last chapter for there is less work.

		Rs.	Rs.
Second year, (1872.)			
25 maunds seed, at Rs. 30 per maund ...		750	13,936
Nursery‡		700	
Clearing, digging, removing roots, staking, pitting and transplanting the 40 new acres same as above, *viz.,* Rs. 100 per acre		4,000	
Cultivating the 40 acres previously planted and the present 40		3,000	
Buildings		3,000	
Tools		400	
Manager and Establishment† ...		4,000	
General expenses		1,000	
Total 2nd year's outlay ...		16,850	
Interest at 8 per cent. per annum	On 1st year's outlay, one year ...	1,072	
	On 2nd year's outlay, six months...	674	
			18,596
Third year, (1873)			
20 maunds seed,§ at Rs. 30 per maund ...		600	
Nursery§		500	
Clearing, digging, &c., &c., for 20 new acres as detailed in the last two years. Half the amount; this being 20, instead of 40 acres		2,000	
Carried over ...		3,100	32,532

‡ Expenditure for both seed and nursery is greater, as in addition to 40 acres new cultivation this year, any vacancies in last year's cultivation have to be provided for.

† Establishment is a trifle less than calculated in the last chapter for there is less work.

§ The intended cultivation is only half, of the previous two years, but the vacancies in 80 acres have to be provided for.

	Rs.	Rs.
Brought forward ...	3,100	32,532
Cultivating 80 acres previously planted and the present 20‖	7,000	
Buildings for tea manufacture ...	2,000	
Repairs of former buildings	350	
Tools	500	
Manager and Establishment† ...	4,000	
General expenses	1,000	
Total 3rd year's outlay ...	17,950	
Interest at 8 per cent. per annum. On 1st and 2nd year's outlay for one year...	2,420	
On 3rd year's outlay for six months ...	718	21,088
Total ...		53,620

The garden is now made at a cost including interest on all outlay of Rs. 53,620. Add as below Rs. 1,000 for buildings 4th year, making a total outlay to make the garden of Rs. 54,620.

Fourth year, (1874.)

Cultivating the hundred acres made, which includes all the expenditure on the garden except tea manufacture (see last Chapter XXIX.)*	10,500	
Further buildings for tea manufacture ...	1,000	
Carried over 4th year's outlay ...	11,500	

‖ Rate higher per acre than last year, as a good deal more manure is used now and the pruning is heavier.

† Establishment is a trifle less than calculated in the last chapter for there is less work.

* The amount calculated in the last Chapter for 100 acres is Rs. 12,000. I assume Rs. 10,500 and Rs. 11,000, the fourth and fifth years, for first, manure at the rate there estimated will only be given to a part of the garden, and secondly, the pruning is for younger plants, and will be less.

		Rs.	Rs.
Brought forward 4th year's outlay ...		11,500	53,620
Interest at 8 per cent. per annum.	On 1st, 2nd, and 3rd year's outlay for 1 year ...	3,856	
	On 4th year's outlay for 6 months ...	460	
			15,816
Fifth year, (1875.) ...			
Cultivating the 100 acres* ...		11,000	
Interest at 8 per cent. per annum.	On 1st, 2nd, 3rd, and 4th year's outlay for 1 year ...	4,776	
	On 5th year's outlay 6 months ...	440	
			16,216
Total all expenditure, including interest to end of fifth year (1875) see the table in the next Chapter			85,652

Sixth year (1876) and seventh year (1877) we may calculate the yearly expenditure as set out in the last Chapter, *viz.*, Rs. 12,000 per annum and Rs. 1,000 more for the manager, making in all Rs. 13,000 per annum. From eighth year (1878) we must add still another 1,000 for the manager and Rs. 2,000 for an assistant, making in all, Rs. 16,000 per annum, at which amount the yearly expenditure can always stand, for the plantation is never to be extended, and all costs for the manufacture of the tea are not allowed for in this estimate. See the table in the next Chapter in which all this is carried out.

The good pay the manager will get after the seventh year,

* The amount calculated in the last Chapter for 100 acres is Rs. 12,000. I assume Rs. 10,500 and Rs. 11,000, the fourth and fifth years, for, first, manure at the rate there estimated will only be given to a part of the garden, and secondly, the pruning is for younger plants and will be less.

he will richly deserve, if he carries out the figures given here and later.

No more must be added for interest, as during the sixth year the receipts will be largely in excess of the expenditure and will so continue all following years. This will be shown in the next chapter.

The above amount of Rs. 85,652 as may be seen, is made up as follows :

	Rs.	Rs.
Actual outlay to make the 100 acre garden with buildings and all complete ...	49,200	
Interest on the above amount ...	5,420	
		54,620
Cost of carrying on the garden (including all outgoings except those connected with tea manufacture) from beginning of 4th to close of 5th year ...	21,500	
Interest on the above ...	9,532	
		31,032
Total as above...		85,652

In none of the estimates of cost, up to this, is the expense of manufacturing the tea included. It would have been very inconvenient to do so. The cost is so much per maund of tea and I prefer estimating the tea at its market rate *minus* the cost of manufacture as shown at end of Chapter XIV.

If this estimate is approximate (and it is I believe near the truth) a 100 acre garden will cost close on half a lakh of rupees. Perhaps this again will seem high to some, but I know from experience a *good* garden cannot be made for less. A 100 acre plantation in a good district, and on a good site, on the making of which half a lakh of rupees has been *judiciously* expended, will I believe give a larger return *eventually*, than any investment, at present open, in India.

The above estimate includes any possible *proper* Calcutta charges.

CHAPTER XXXI.

How much profit Tea can give.

We have already estimated the cost of making and cultivating a plantation of 100 acres. We must now ascertain how much tea that area will give yearly.

It is a very wide question what produce an acre of tea will give.

The following is an extract from the "Report of the Commissioners appointed to enquire into the state and prospects of Tea cultivation in Assam and Cachar," addressed to the Government of Bengal and dated March 1868.

"*Average produce per acre.*"

"The returns of actual produce of gardens in 1867 which we have obtained are so few in number, that it is impossible to take any general average from them. The produce in these varies from three and-a-half maunds to one and-a-half maund per acre, omitting the more recently formed gardens.

"From information received during our tour, we have reason to believe that some gardens produce more than the highest rate per acre here mentioned; but, in the absence of returns of exact acreage and out-turn, we cannot notice these instances.

"Mr. Haworth, in his pamphlet already quoted, speaks of the produce of Cachar gardens as follows :

'I believe that three maunds per acre is fully one-third more than the present average yield of garden in Cachar, after deducting the area of plant under yielding age.

'There is no reason, that I am aware of, why the yield of tea should not soon be raised to four maunds, and more gradually six maunds per acre, equal to twenty-four maunds of leaf per acre (less than one ton per acre for a green crop, which is still a very small one.) Even now there are gardens in Cachar which give an average of from five to six maunds per acre this season. Some of these gardens have really no apparent advantage over their less fortunate neighbours, beyond that of a somewhat better system of cultivation and pruning; and these improvements even are to such a small degree a-head of the general practice, that I feel justified in saying I cannot place a limit on what the increased yield should be under a more rational system of cultivation, and the application of manures on a liberal scale, leaving out of consideration altogether what might reasonably be expected from a good system of drainage in addition.'

"Mr. James Stuart, Manager of the Bengal Tea Company's gardens in Cachar, has also given two maunds an acre as the general average of Cachar gardens for the past season, including young gardens of two, three, and four years old.

"We do not think it necessary to quote in detail the opinions of all the gentlemen examined by us on the subject of average produce per acre. A garden that can give four maunds per acre is undoubtedly a good one; and we have no doubt there are such, or even better; but we do not think they are so common as to warrant our taking more than three maunds as a safe average."

Mr. A. C. Campbell, Extra Assistant Commissioner, at Burpettah in his "Notes on tea cultivation in Assam" published in the Journal of the Agricultural and Horticultural Society of India, Part 3, vol. 12, page 309 says, "Good tea land can be made to yield as high as seven maunds per poora." I forget exactly how much a poora is, but I believe it is near an acre.

In the Report to Government by the Commissioners, quoted above, at page 9, Mr. T. Burland after estimating the cost of cultivation per acre, per mensem at Rs. 9-10-2 adds, "With the above expenditure per acre, it is probable that much more than five maunds of tea will be obtained from an acre of fair plant."

All these estimates though are based on the cultivation of tea as carried on hitherto with few exceptions, that is to say on gardens covered with weeds for many months in the year, and to which no manure has ever been given. With such cultivation, particularly on gardens planted on slopes, I think myself that the yield will not exceed four maunds *at the outside.*

High cultivation and liberal manuring will, I believe, at least double the above, if the plants are of a high class. However here I give a Table on the subject which I have carefully framed.

Estimate of probable yield per acre if really high cultivation and liberal manuring is carried out.

Year.	Detail.	Estimated yield per acre in maunds.*
1st	The year seedlings are transplanted into the garden, supposing 1871	......
2nd	1872	......
3rd	1873	1
4th	1874	2½
5th	1875†	4
6th	1876	5
7th	1877	6
8th	1878	7
9th	1879	7½
10th	1880‡	8

* Calculating tea by maunds is convenient, inasmuch as pounds necessitate such lengthy figures for all calculations. The maund here employed is however quite an arbitrary measure. It is *not* the Indian maund, it equals and is represented exactly by 80 lbs. Any number of maunds multiplied by 80 will naturally give the lbs. of tea.

† Up to this point, *viz.*, the 5th year inclusive, the figures given have been actually realized and that on a garden with 15 per cent. vacancies. It has been though highly cultivated and liberally manured from the first.

‡ From the 5th to the 10th year is assumption except that I know one garden which, to my certain knowledge, has given *more* than 10 maunds an acre in 1870 and this in spite of about 15 per cent. vacancies. The garden is an old one planted about 15 years ago. It is also a very small one. The soil is *very* poor, but the plants are of the highest class. It was much neglected till about five years ago. From that time it has been highly cultivated in every way except in the point of irrigation, for it has not that advantage. It has been most liberally manured.

I do not think plants reach to perfect maturity under ten years. Certainly not with ordinary cultivation; perhaps with high cultivation, seven years would suffice.

The 2nd year (1872) the plants should not be picked at all, with a view to make tea. They must be tipped however and a little tea will thus be made. As however it can be but little, it is disregarded in this table.

That eight maunds per acre as estimated in the table just given *can* be realized, under the conditions stated, I have no doubt whatever, but I am equally certain that the size of most gardens in India must be much reduced if even five or six maunds, are looked for. Not only must they be reduced in size, but they must be highly cultivated, must be manured, and no vacancies allowed. However, I have dwelt on all these points before, and need not repeat here, for unless the reader is convinced before this that a large area and low cultivation won't pay, it were waste to write more.

I now give a table showing the result for 12 years of a plantation such as I have advised.

(For Table, see page 299.)

The above table has been drawn up with great care, and if looked into, it will be seen that the results given in columns 2, 4, 5, 6, 8, and 10 have been arrived at in other tables and chapters.

From this table it appears (column 11) that not until the 6th year, will there be any profit on the working expenses, and that not until the 10th year (column 15) will all the outlay in the garden together with interest on the same at 8 per cent. per annum be recovered.

After that, as shown (column 11) the profit will be very large, amounting to Rs. 24,000 per annum from the 12th year, when the whole garden will be in full bearing, and a large profit yearly from the 6th year upwards.

Believing as I do that this table fairly represents what tea

can do, I advise no one to embark in it who has not a capital of from 60 to 70 thousand rupees (this will suffice see column 16). If he has this and can secure *all* the following advantages, *viz.*:

1. A good climate.
2. A good site.
3. Perfect knowledge in tea cultivation and tea manufacture on his own part or that of his manager.
4. Seed from a high class of plants.
5. Local or cheap imported labour.
6. Facilities for manuring.
7. Cheap transport.

he may safely do so and hope that his six or seven thousand pounds will eventually give him a clear income of £2,000 a year at least.

Let him not dispense though with even *one* of the seven points named, if he would ensure success, for the truth simply, that tea will pay *very well* with all the above advantages, but will utterly fail without them.

Such is my advice to intending beginners. To those who have gardens, I say, reduce your areas till of the size you can really cultivate them highly, and procure manure at any cost.

I shall not have written in vain, and tea enterprize in India will flourish, if the motto of planters in future be

"A small full area, highly cultivated."

Prize Essay on the Cultivation and Manufacture of Tea in India. By J. F. W. Watson, Esq.

Premium: Two Hundred Rupees and the Grant Gold Medal.

PREFACE.

In this essay, while I have endeavoured to describe fully every branch of work appertaining to the cultivation and manufacture of Tea, I have made it my special aim to detail more particularly what I know of *improvements* in the ordinary accepted methods.

I have given throughout the average cost of working, but I have not dealt much with estimates, as these usually meet with so much alteration in practice, and depend so greatly upon the chances of fortune, as to render them somewhat uselessly theoretical on paper.

The object of the Society would, in my opinion, be best attained by as wide an interchange of the results of observation and the fruits of experience as may be fairly practicable; and as their liberal offer will doubtless have induced many planters to take to the pen, it would be well, I think, if they were to divide their prize or else increase it, as no one essay can be thoroughly exhaustive of the subject, or contain every thing that is new; and it is this last sort of information that is really wanted.

February, 1871.

Climate.

Little need be said under this head in an essay of this kind, aiming, as it does, to be a brief practical disquisition. Tea in India, so far as we know, will only grow in the Bengal Presidency, and Assam and Cachar have the only true climates therein. The districts bordering the Himalayas from Bengal Proper to the Punjab have climates of very secondary suitability, while Chittagong as yet has shewn itself far in the rear.

Minute experiments have, I believe, been made in the Neilgherry Hills in Madras, but little is known of them, and whatever may be the capacities of China, the range in India is few, its size limited, although the one province of Assam could, were there no labour difficulty, supply the whole English market. A warm steamy climate, with the sun powerful, and the rains not too heavy, yet plentiful, and their prevalence well spread over the year, together with a cold season where the temperature just stops short at hoar frost, is, as every planter knows, that in which the tea plant will most luxuriate, and put forth its utmost strength.

These conditions are best found in Central and Upper Assam, and, I believe (for I cannot speak from experience as to this latter district) in Cachar. In Assam the duration of the rains are as a rule all that could be desired, for they commence in March and end in the latter part of October, although of late some severe exceptions have gone to "prove the rule."

Plucking then commences in the middle of March and ends in the middle or end of November, so that the tree is worked for actually eight months in the year, and often for more nearly ten. This is very different to the season in Chittagong or the North-Western Provinces. In Dehra Dhoon there are two distinct seasons and two crops, the spring and the rain. A leaf is never plucked before the beginning of April, in the spring time of manufacture; and the spring crop is gathered in about the course of a month; but in this month or five weeks, one-fourth of the whole produce is generally made. A fierce interval, the hot weather then commences, and the plant is severely tried under a tremendous sun and scorching hot winds, (which often render the nights positively dewless) for another month or six weeks, when the rains come abundantly and favorably. The rain is made from the beginning of July till the beginning ovember, before which latter period the rains have gener-

ally ceased for a fortnight. The Dhoon it will be thus seen has only five months of tea making; but these months it must be remarked are all *good* ones, and the plucking is almost uninterrupted. Three maunds per acre is now being obtained here from well cultivated gardens, but it seems doubtful if this can be increased. The Dhoon however is quite behind Assam in respect of climate, but as a set-off it has the great compensation of an abundant supply of local labour, and much of the tea can be disposed of locally to respectable native merchants, who purchase for the Cashmere and Bokhara markets. The great fault of the climate of Darjeeling is admitted to be the excessive rain-fall, which frequently retards the flushes, and renders the leaf hard and coarse. Another serious evil attending the excessive and continuous fall of rain is the impossibility of manufacturing as fine tea as in moderate weather of days alternately sunshine and showers, for no matter how fine the leaf may be when gathered, if much of it is coming in, it will cause inconvenience by slowness of withering; will be difficult to work up, and will turn out with an undue proportion of dust and ill-coloured tea finally. The Darjeeling teas are however so very good, and of so peculiarly fine a stamp, even if lacking in strength, that the climate must have its particular excellencies to produce them; and its defect is undoubtedly preferable to that of the Chittagong climate which is of a directly opposite nature, too severe drought. Finer plant than is to be seen in the latter district could not be desired; but the yield has hitherto been very poor; while the climate approximates more to that of Lower Bengal than to the requisitions of a tea country. The place as yet it must be allowed has scarcely had a fair trial. I have seen gardens there which appeared to be capable of giving the most satisfactory returns, and the district has enjoyed so far the blessing of a sufficiency of local labor, which want goes far to neutralize the superior climate influences of Assam. I ha

no personal experience of the Kangra or Kumaon climates. The teas, as is well known, are of very delicate flavor, but deficient in strength, and this is most probably owing to the deficiency in the climate of the warm steamy weather of Assam. Tea and fever it is said always go together, and these latter localities have the reputation of being healthy and highly favorable to the European constitution. The vagaries of the tea climates are becoming so frequent as to cause the uneasiest apprehensions to those interested; and in Assam it is believed that a permanent change is taking place, for of late years there have been droughts of a length and recurring regularity utterly unknown in former times.

The cause is believed to be the extensive denudation of the province of timber by the ever increasing wants of the greatly extended cultivation, and although we think it would be premature to assert that there is any fixed difference as compared with former years, it is highly probable that the cause assigned has to a great degree this effect. I know that some planters are seriously considering the possibility of introducing irrigation, and an ingenious idea of using a watering engine in connection was lately hinted at in one of the Calcutta papers. As to this I can say that I saw a friend act on this suggestion on a very small scale by using a common force-pump to water seed beds and nurseries, and with complete success, and the plan might be quite practicable in a large measure, and could be made perfectly so where the cultivation might border on running stream, even if very small ones. The water in many of the large unused tanks, to be found about Assam gardens might be often thus utilized.

Tea is sometimes irrigated in the Dhoon, where there is a regular canal system, and I have so watered tea myself with undoubted benefit in the hot weather, but merely as a *preservative,* for I have little faith in canal water producing flushes. Indeed at the time when it would be necessary to water in the Dhoon, *i. e.,* the hot weather, the tea would not

be apt to shoot, and anyhow one slight plucking would be the most that would be got.* But it is enough that it will be the means of perhaps *saving* the bush, and in Assam were the system adopted, flushes might be obtained, for the hot weather of the Dhoon is very different to the exceptional spells of hot weather in Assam. I seriously think that by using a large pumping engine, supposing the supply of water unlimited, the loss of leaf at such times would be greatly decreased. As to how the different climates suit the different varieties I believe that the Assam, the plant *par excellence*, does very well at Darjeeling, but flourishes best in Assam and Cachar. It does not seem to do very well in the Dhoon. Out of Assam I fancy the hybrid will be found to do best, and the China I believe to be the most tenacious of life anywhere.

Soil.

In tea planting this should be the first consideration, and it is the one of supreme importance, being far superior to those of seed locality, &c., as its soil is in every respect to a garden what his constitution is to a man. No great or lasting results will ever be achieved on bad or indifferent soil, brilliant though the first fruits may have been, and bright the delusive prospects, and that this is as true as it would ordinarily appear self-evident many could tell by their own bitter experience. The best description of soil for tea is a light loam of a yellow reddish colour, and porous enough in consistency to admit of easy and certain filtration. This sort of soil may be considered as the standard of excellence, and will generally be found in its purity in old forest land, and in the long uncultivated or virgin grass land adjoining. In the forests there will be found, as a rule, an upper layer of blackish earth to the depth of two or three inches, a rich vegetable mould in fact,

* As to this, however, it must be said that there is a prejudice against irrigation in the Dhoon, which I am inclined to think, a fairer trial than has yet been given it would remove.

and should the reddish-yellow crumbly soil be found beneath this, and to the depth of six or seven feet, the would-be planter may safely believe that go where he will, he will not find better. But although this may be considered *the soil par excellence*, there are several others on which tea will both grow and thrive. There is the stiff, heavy clayey soil, which is frequently of a bright red, or brick color: there is the poor darkish loam, and the sandy white soil. It often happens too that the finest soil has only a depth of two or three feet with either pure sand, or gravelly sub-soil, or cold blue clay beneath. On some of the poorest of these descriptions, plant of the utmost excellence of growth and appearance will be repeatedly found, and indeed the shrub has such an indomitable hardihood of nature that it will flourish amid the most uncongenial surroundings; while it will so generously repay careful cultivation as almost to induce the belief that granted such cultivation and a suitable climate, it will thrive and yield well on any soil. I have often heard advocates of this theory assert that with plenty of labour they could grow tea *on a rock!* But I fancy as the years have rolled on they have grown the wiser. On the light sandy soil just mentioned the vigorous progress of seedlings is often astonishing, and if the object were to grow a large year-old seedling, it could be best done on such soil in Assam, where excessive drought is on the whole rare, and where this soil has abundant opportunity for its rapid and sensitive absorption of moisture, and its quick filtration, both of course highly conducive to the needs of the seedling, which never feels the lack of the stamina demanded by the *tree*. The yield for the first two or three years will from the same reasons be often in excess of that on superior though slightly stiffer soil. Stiff, clayey soil will conversely not produce quick growing seedlings, unless with special and extraordinary devices being adopted, and these are impracticable on a large scale. I have a great objection to clayey soil. One will find it growing splendid tea repeatedly, but it is not

the sort of soil the plant will flourish best in, nor as a rule yield well in, and its sole advantage is its superiority in times of drought, which periods ought to be rare and exceptional in every tea country. The deficiency in yield on this soil is often most serious, and it may be accepted that the yield will always be less than on good porous loam. The poor darkish stamp of soil is, I am convinced, the worst of all. In sandy soil you at least will have something at first, but on this kind you will never be able to grow good seedlings or good trees, and it will be disheartening work from first to last. Little more need be said on this head: for those who are so unfortunate as to have plant on poor or bad soil, the only hope is in careful manuring, but to those who may be going to invest, I would recommend the most searching investigations as to soil in the first instance. I would counsel the avoidance of all, but the best variety of soil, which as I have said before should be light but rather rich yellowish loam, and there should be abundance of it. I consider six feet in depth of good soil to be indispensable if a garden is to be regarded as a profitable and lasting property. Sub-soils of pure sand, of bluish-grey clay, or of large pebbles and boulders should be distrusted, and such spots avoided, unless these characteristics occur at great depth, for if they are found at three or four feet from the surface the plant there will never be long-lived, or at best it will but live, but never will flourish or yield other than meagrely; it will inevitably become a surface feeder, depending for support solely in its upper lateral roots, and prone to wither and die out at any time of drought, though such should be of but short duration. I would ask many of those who with great perseverance and persistency are going on year after year filling up vacancies to consider the probability and the cause of this necessity being a poor and insufficient soil from the first, and this soil being now thoroughly impoverished and in every respect unsuitable.

In conclusion, I would remark that all soils may be improv-

ed by the application of manure, even the very best after having been under cultivation for a few years. The most suitable manures for the different kinds of soil are naturally those which supply such qualities as the soils may be originally deficient in, thus for heavy, wet or very tenacious soils ashes are best, as besides enriching, they improve the consistency of the land. Conversely, for light sandy soils composts of rich mud, &c., are desirable (*vidé* Remarks under the heading *Manure and the effects of its use*). It should also be understood that a good loamy soil requires less manure, and "keeps in heart" with less than either clayey or sandy soils.*

Selection of Sites.

In selecting a site, or in considering the merits and demerits of a site on which a garden has been made, the first thing to be done is to ascertain if there is a sufficient area of really good tea soil on that site, and this should in all cases be done by having large holes of six feet in depth and four or five in width dug in many parts of it. This satisfactorily accomplished, the natural drainage should be thought of, and this can be known easiest by seeing how the tea land stands to the land and water surrounding and adjoining it, whether it stands well above the streams that may bound it or cross it, and if there are falls from it to any low and swampy land near it. It should also be ascertained if there is a good and plentiful supply of drinking water easily attainable. These considerations are of chief importance, and should rank far above those of accessibility to roads, rivers, and villages: these latter are of importance too, but the former qualifications are absolutely indispensable, and questions of convenience should never be allowed to clash with them. Where they *have been*, fatal

* Some of the finest tea soil is to be found in the Seebsaugor district, Assam, also in the district of Tezpore. In Upper Assam a good deal of heavy red clayey soil is met with. The Chittagong tea soil is of very good appearance, and so is much of the soil of Dehra Dhoon, the latter's defect being its somewhat too stony nature.

mistakes have frequently been committed, by the rejection of high well-drained positions with good soil, because they were somewhat remote, and by the preference of doubtful places that had the advantages of good water carriage and proximity to villages. It is of course highly desirable that the lay of the land should be good, and either level, with good natural drainage falls, or undulating, but always remember *soil* before every thing. With equal advantages forest land should be preferred to grass plains. It is but natural that tea should have the former for its growth. Forest land is undoubtedly very expensive to clear, but it is more easily kept clean for the first two years, and there can be no question as to the *seedlings* having a better chance of life and vigorous growth, and the finest patches often on grass land will often be found to be from transplanted seedlings. But never hesitate to prefer grass land with good strong soil to forest land with doubtful or indifferent. As a rule, however, all the advantages are with the forest, and where tea is planted on grass land, it is generally because no other is obtainable, or from some marked superiority of soil. Grass expanses are very desirable as adjuncts for building purposes, supply of thatch, &c. It is, I believe, a fact however, that at periods of epidemic sickness, grass sites are sooner attacked and more sorely ravaged than those on wooded land, but on the other hand they must be much freer from malaria, and are undeniably more cheerful. In choosing a site the evil of inundation is not to be disregarded, and particular enquiries should be instituted as to any hill nullahs that may be near. Keep as far from these as may be, for they are treacherous neighbours, and at some future period might make your smiling garden an "abomination of desolation." Unless their channels are of considerable depth and of very permanent appearance, do not plant by them or on land they cross, as their course is at all times uncertain, and any change in their sources may make a fatal difference in their nature. Undulating land, or level land well raised, is much

preferable to hilly ground, which should, if possible, be avoided, as the tea rarely succeeds so well as on the flat, and it is more difficult to work, while later on the washing of the earth from the roots of the plants during heavy rains may prove a great evil. It should always be observed if there are conveniences for the establishment of a factory, including plenty of space for coolies' lines about, that there is good, flat open space and good drinking water procurable; and the nature of the ground as regards the future probability of having to sink wells should be ascertained. It is not likely that any one could fall on a very advantageously situated piece of land now-a-days, and to get the benefits of a good site he would have to purchase an established garden or take shares in one; but to conclude this part of my subject, I will say that the possessions of a *ne plus ultra* site are good soil, and a large and compact area of it; abundance of timber, a deep navigable stream as a boundary; populous villages close at hand; and a good road; which if a man can obtain, he need feel no doubt, if everything else is right, as to the propriety of commencing operations.

On the laying out of a Garden.

The best land on the estate will of course be selected for cultivation, but care should be taken to reserve suitable spots of sufficient area and in good situations for the homestead, the factory, and the coolies' lines, for it is quite as important that these should be in as good positions as the garden itself, and their sites should always be selected first. I do not counsel that the very best parts of an estate should be so reserved, and the site of the garden made a secondary consideration, but the requirements of the factory and of the garden are really of equal importance, and need the exercise of as much foresight, while too frequently sufficient attention is not given to the future want of good building sites at the commencement of clearing. Ordinarily, it is to be hoped, the

planter will have plenty of suitable ground for all his needs, and he should only have to bear in mind that his building sites should be on the handiest and airiest parts of his property. He will then naturally choose the most unbroken stretches of tea land for operations, and the remarks made under the heads of Sites and Soil should be remembered—the natural drainage and the actual quality of the ground should both be carefully ascertained. It is an easy matter to dictate the best fashion of laying out a garden, the practical question is, has the planter got the land in such disposition as to admit of his doing this? The majority have to take their land as they can find it, and a vast number of gardens are necessarily planted in little separate patches of the most eccentric shapes. I would suggest a rule, however, which followed out would be found to be, I believe, a golden one, and it is that a garden should always be laid out in 10-acre fields throughout, these fields being separated by 12 feet roads. If there is a large area in one stretch this can be most easily done, and by the use of the chain, ere sowing the seed; these divisions could be easily made, no matter how uneven the character of the land might be. I believe this plan has numerous advantages. One of the best is that the area of each field being known, work of all kinds can be so easily taken account of and checked. In this one particular I believe such good supervision could be attained and such saving effected as to amply repay the trouble at first and the loss of the land occupied by the roads. Every part of the garden moreover is brought within such easy reach that it is likely to receive more general impartial attention than if in one huge block traversed by perhaps two roads. Experiments also can be carried out with tolerable certainty of accuracy in data, and if the fields are numbered, the work can be directed with the utmost precision. Another advantage is that manure can be *carted* through the cultivation and laid down wherever needed, instead of having to be *carried* a great distance, over rough hard ground. I

am managing a garden of 300 acres all in one block, but sub-divided as recommended, and I can testify that the ease and certainty with which one can work as compared to the working of a garden not so divided are very considerable. The sense of vastness which often strikes one in looking over an unbroken expanse of 150 or 200 acres, and the accompanying doubt as to whether every separate bush is being carefully plucked or pruned, are both done away with, when each khet or field can be thought of by itself; while the rapidity with which the ground can be got over (and the comfort likewise), by both man and beast, is of itself a great thing, and should be appreciated by those who know how tedious a long stumbling trudge through an extensive field is. I would even go the length of saying that it would *pay* to make such subdivisions in old gardens where they are non-existent. I believe it would pay in the certainty as to work done, while facility in working properly will always pay for its attainment.

Assuming the matter of roads to be disposed of, the distance of sowing is to be considered, and this is a topic whereon opinions are many. It is generally agreed, however, that the Assam variety requires more room than the hybrid, and the latter again more than the China. The first variety used in former days to be sown 6 feet by 6, and in very good soil, with plenty of labour available, this is still a good measure; but as a rule it is much too wide, and the distance would always need very good growth to render it advantageous. On ordinarily good soil I consider 6 feet by 5 as good a measure as can be for pure Assam plant. This allows it ample room to expand while, as compared with the first measure, a great deal of space is saved. Five ft. by 5 is for Assam plant, if any thing good is expected from it, rather too close, but if the soil is not very first class, it is not a bad measure, and it is one very generally adopted; but with good soil, I should prefer the former. Five ft. by 5 is a very good space for

hybrid on superior soil, but I prefer 5 feet by 4. Four ft. by 4 for hybrid is very much followed, but if superior development is hoped for, one would wonder how it is to be attained. Some of the best hybrid that I have seen has been sown 5 feet by 4, and that is certainly my preference. Those who choose the narrow measures of course look chiefly to having the area well covered and quickly covered, without much reference to the growth of the separate bush. (There are many places like this with *Assam* sown 3 by 3 feet). A great deal can be said for this plan, and quicker returns may, undoubtedly, be expected, but good bushes at fair distances, well cared for and properly trained, will cover the area with as much certainty, if not with the same rapidity, as bushes planted much nearer; and of the two covered areas I should much prefer that of the wide-planted, well-developed bushes. I believe such bushes would last longer and would flourish in later years more abundantly, one reason being that they would take less out of the soil, than the closely conglomerated mass of roots of the thickly planted trees, and the soil while not having the same excessive call made on it could at the same time be further strengthened by the possibility of good cultivation, which it could not get to the same degree as in the other plan. I am not speaking in this matter altogether from supposition, for in the cold weather of 1864-65, I planted out some hybrid at 3 by 3 feet and some at 4 by 4 feet, and the latter yielded more in the fifth year (1869) than the former, although as might have been expected the close plants gave more in the two first years of yielding. "Cover your ground" is the motto of those who advocate close planting, and I agree with them, but not in the means they propose. "Cover your ground" I say, with well grown vigorous bushes, at such distances as will let them grow and admit of cultivation, and it is perfectly possible to cultivate such planted ground well, either by the hoe or plough, but almost impossible to use either, if the underwood is so thick as is generally

the case in very closely planted fields.

For China, on *ordinary* soil, I should say 3 feet by 3 feet is the best, but on *very good* soil I think 4 feet by 3 feet would be better. Three ft. by 3 feet is however a very good standard distance at which to plant out China, which is not naturally so large a bush as either of the others, and yields so poorly in comparison as to necessitate there being plenty of it. I would recommend the formation of nurseries simultaneously with the planting out at stake. Vacancies will occur and they are in many cases the canker-worms of an estate. A handier way, in making a garden for the first time, is to sow an extra line at every tenth line, and the plants in this extra line should suffice for vacancies at the end of the first year, with the advantage of being close at hand. Many planters always sow two seeds to a stake, and thus have double bushes, but unless the quality of the seed is doubtful, I do not see the advantage of this. Certainly it should not be necessary with seeds that have germinated, or that appear heavy and sound, and if there is good probability of the garden being kept clean during the following rains. Nobody should commence to plant tea unless he is thoroughly sure as to this latter point, for failure may throw him back for years.

To those who admire avenues, the Toon, Sisoom, Nahor, &c., trees can be recommended, although except for the main road and only for a portion of that, I do not see any advantage in having them. To have them by every road is in my idea to spoil the fine sight presented by a large well ordered garden, while they afford a tempting shade to skulking labourers.

Nurseries.

These are formed for two purposes, *first*, for the growth of seedlings for primary planting out, and, *secondly*, to supply seedlings to fill vacancies among the plants already under cultivation. In each case the site of the nursery should be very carefully selected, and the land as carefully prepared, for

seedlings are worthless unless they are good ones, and these are the two first essentials to this result. Forest-land should always be chosen in preference to any other, as shade is absolutely necessary, and of course it is better to have it of a natural than an artificial kind, expense alone being of no small consideration if the latter has to be adopted. The soil should be virgin, or such as has been unworked for many years. If there is any doubt about its quality, and better is not to be had, manure should be liberally laid down both before and after the seed is in. Many people prefer to have every stump rooted out, and unless there are very few of them, and these of small size, it is better to do this, as the roots may extend widely and may stunt or kill many a young plant. In clearing, a liberal allowance of shade should be left, but of course not enough to be in any way dense. Assuming the land to be equally good, it would be preferable on the score of expense to select a piece of light forest in preference to a spot covered with heavy timber, for most of the trees would have to be uprooted on the latter, and to do this would cost both time and money to an unnecessary degree. The land should then be thoroughly well hoed to the depth of at least eighteen inches, and as far as possible all small roots removed by hand. If the nursery is made for planting out a garden, it will be obvious that the seeds must be sown pretty closely together. A very general and good plan is to raise beds whose length is that of the nursery itself, their breadth being about six feet, with a path of eighteen inches separating them for convenience of keeping them clean. The seed is planted across the bed in rows which are six inches apart, and between each seedling in the rows there is a space of two inches. The lines in short being 6 inches by 2. Such plants are lifted in the rains following their sowing, and are taken up like cabbage plants on favorable days, either cloudy or rainy, and planted without any earth attached. This method of making a garden is

compulsory in the Dehra Dhoon, and in Chittagong, and is followed sometimes by preference in more favorable districts. But the expense and disadvantages are great as compared with planting seed. At stake where this is practicable, and other circumstances being equal, plants by the latter method will invariably be superior at the end of the first season. This is generally known and admitted, and when seedlings are planted out in the first instance in Assam, it is usually because the planter sees no possibility of getting this land ready in time to allow of sowing out at stake; but making his nursery he proceeds to clear, and during the year clears and plants out as much as he can, and does so frequently with great success.

Nurseries should be kept most scrupulously clean. This can be done well by hand weeding, or with koorpees such as syces use to get dhoop grass with. Every little weed should be destroyed immediately after appearance, and the young plants should get all benefit possible from the well cultivated soil. Unless this condition can be ensured it were better not to make a nursery at all, for a neglected one seldom recovers, and when made for the present purpose the necessity for recovery would not exist; and it should be always borne in mind that a vigorous seedling has to encounter many dangers ere it can become a tree, (the mere act of transplantation being very trying to it) and this being so, what can be expected from a weak one. In the arrangement of the nursery at the first only such number of seedlings as it is believed can be transplanted during the succeeding year should be put out in the manner indicated. If any doubt exist as to this, portion of the ground should be laid out at wider distances 4 inches by 4, 6 by 4, or even 6 by 6, so that if the plants cannot be removed in good time, they may have some room in which to grow, and in such a way as to render their removal a matter of little difficulty. At the narrow distance the plants will *grow* indeed well

enough, and the whole place would soon be a monster tea hedge, but the lifting of them will be found to be a risky job, only to be done at all in wet weather, and then with every chance of the plant having such unfair treatment in the taking out when jammed and entwined almost inextricably with others as to render likelihood of survival most uncertain, whereas, if they are planted at the distances just mentioned, they can be easily dug out and lifted separately. If they have been allowed to grow up in a mass it will be found almost impossible to take them separately, and the best way then is to cut them out in small squares or rather cubes of three or four inches in length and breadth, the depth being, of course, slightly more than that of the root. In this manner some of them will be preserved, and may grow up into very good double-bushes.

In the Dhoon and Chittagong where all planting out is done from nurseries necessarily on account of the long hot interval preceding the rains, tatties are used, more particularly in the former district, where forest land is scarce and rigorously conserved. While under these the seedlings are regularly watered in the Dhoon, and the canal system renders this an operation of ease and certainty, which is not the case I fear in Chittagong. As I remark in another part of this essay I have seen the idea of irrigation much improved by a common force-pump (costing Rs. 25) being used. This throws in a short space of time abundance of water for a small nursery and seems in every way preferable to ordinary irrigation. One man can work the pump very well. An ordinary double-action pump would water nurseries very efficiently. I have written so far of nurseries meant to supply seedlings for the original planting out of a garden: those formed to supply seedlings for vacancies should in my opinion be laid out on a different plan. With this view I fancy numbers of my fellow planters do not agree, for nurseries may be constantly seen planted apparently as close as they can hold,

and for this very purpose. I have known instances where tea seed was sown as thick as mustard and cress, and the seedlings were afterwards *thinned* by the superfluous ones being pulled out and thrown away, and although these were extreme cases I believe that close planting, by which I mean, say five or six inches by one or two inches, is very generally followed. Under this method the plants are taken up in the rains and dibbled in, and the rule usually laid down is that after the plants are six inches high they should be taken out and transplanted at every possible opportunity. The way I shall recommend is different, and after frequent experiments and much observation of the operations of others, I am sure it is the only safe and certain plan, albeit, probably, rather more expensive. In this arrangement the seeds are sown out at little stakes one foot apart, and these are then at a distance of a foot by a foot, small paths at five feet apart in the *width* of the nursery being left for convenience of weeding. If instead of a foot, fifteen inches distance be given, the plan can be carried out in its entirety, by the seedlings being allowed to grow up untouched until the end of their second year, when being pruned, if of good growth, at say 2 feet 10 inches, they are carefully dug out and transplanted, a little manure if possible to be laid round them after that. This method is certainly more expensive than the other because in the first place more land is required and *secondly*, because the labour of digging out the large seedlings and carrying them to their destinations is much greater. The first item of expense is more imaginary than real, and it may be more correctly said that you get fewer seedlings on your area than that you need more land under this plan for your seedlings; for I hold that a very large nursery is a great mistake, the chances being that it never gets properly looked after, and that half the plants are left after all. An acre or two acres is quite as much as should be attempted in one season, and I have seen the wide planting of seedlings result in success

from times to the other's one. Indeed, if we come to look at the subject carefully, it is natural that it should, for in many cases the seedling after being lifted has to go to encounter many dangers, the first of these being the transplantation itself, and here I believe the big one lifted with plenty of firm solid earth round it in the cold weather when the sun is powerless, has a better chance than the little one, which is lifted in the rains, probably on a rainy morning, which may be followed by a hot burning sun at noon, or by probably one or two days of strong sun. Then again the soil of the old cultivation which may have been worked for six or seven years or more is very different as regards the seedlings' requirements from those of the nursery it came from, and the growth of one transplanted in July is sure to be very poor, for the latter half of the year as compared with the growth *up to* July. The seedling from the wide planted nursery on the other hand is on the verge of becoming a "plant," and has had the advantage of the vigorous new soil for two seasons in which it has grown under the most favorable conditions possible for it in the estate, very different conditions to those that may attend the second year's growth, or even half of the first year's growth of the little seedling, for it very probably may be put out among old tea, that from unavoidable cause may be left unhoed for two or three months, and though the grass may not hide the tea, or may as the case may happen, in either event it will be far above the head of the little six-inches, whose life any careless cooley when the hoeing is going on, may imperil. A third advantage to the large seedling is that it is at a pluckable age, and is put out ready in the following spring *for* plucking, and how great an advantage this is, those who have had the taste of trying to keep the pluckers' fingers from seedlings or even undersized old plants ought to know and appreciate. The probabilities are that the little seedlings may be sometimes torn in half by unscrupulous hands whose only thought is

how to fill their baskets. I have frequently seen such small seedlings come to nothing for years, and allowing even that they escape the dangers of single and surreptitious plucking the soil is not suited, however clear it may be kept to develope their growth. My experience is that to procure the desired result of good trees in existing vacancies you will need fair seedlings of the close sown system to one of the wide, and this should more than equalise the trouble and expense of the latter. In all cases where practicable, manure should be given to the transplanted seedling, for it has so much to do to hold its own with the other plants, to say nothing of its being expected to come up to them. In Ceylon they have a plan of transplanting which I have heard recommended for tea, though I should imagine the expense would be altogether too great. The seed is sown in beds and the young seedlings are put into long narrow baskets of about six inches across at the top and eighteen inches deep, which baskets are filled with a mixture of forest earth and manure, and with these baskets as close as they can conveniently be placed, a second nursery is formed. This should always be, I believe, in a well-shaded spot. When the plants are of a fair size the baskets are lifted and transplanted where wanted. A bottom is made to the baskets and this and the sides soon decay and never hinder the growth of the roots. I give this plan as I have heard it, and it might possibly be worth a trial where transplanted seedlings had failed to thrive in the old land. Anything is better than the disheartening and thoroughly expensive work of repeated transplantation.

In regard to the transplantation of *old* plants, I have always found it by far the best and cheapest way to do it in the rains, say after July, and to cut the trees down to within *three inches* of the ground, when they may be removed *without any earth attached to their roots*, always provided that the operation takes place on a cloudy and rainy day. When transplanted, manure, if possible, should be applied, and the shoots of course

should be left untouched. This plan will be found preferable to any other, particularly so to the costly and uncertain method of digging them up roots, branches, and all.

Cultivation, hoeing, and weeding.

Under this somewhat indefinite heading I shall treat first of all of *clearing,* and its cost. In clearing forest land for tea the underwood and lighter trees are cut down, and the large timber is usually left standing; such trees as are not intended to remain permanently being immediately "rung" by making a wide deep ring round and through the back and thus stopping the flow of the sap. A good deal of shade should be left, as it undoubtedly favors the growth of seedlings, and it can be easily got rid of afterwards. The first rough cutting in ordinary jungle can be done by fifteen men to an acre, and it will require at the rate of double that number for the second stage of progress, which consists of cutting up the wood, burning it and getting rid of the debris generally; and before the ground is in proper condition for the preliminary deep hoeing the labour of thirty men will again be needed. After this deep hoeing is given, and by the time that the ground is ready for staking off, the cost per acre will be about Rs. 20, that is to say—

	Rs.	A.	P.
First cutting of jungle.			
15 men's work at a nirrikh of 20 nulls of 12 feet square per man	2	8	0
Cutting up and burning timber, &c.			
30 men's work at As. 2 and 8 pies per man ...	5	0	0
Cutting up, &c., the second time to get the ground ready for hoeing.			
30 men's work at As. 2 and 8 pies per man ...	5	0	0
Deep hoeing, uprooting stumps, &c.			
42 men's work at As. 2 and 8 pies per man, each man doing seven nulls of 12 feet square ...	5	12	0
	18	4	0

This calculation is based on the nirrikhs actually given, and if care be taken to have the land accurately measured, so that the quantity of work done may be as accurately checked, jungle of no extraordinarily heavy nature can be very well cleared for this rate, although in actual practice the estimate like most other estimates will be probably exceeded. If the forest be very dense or of a difficult kind, on account of much underwood, clearing will certainly cost more; but, again, if the underwood is light and if much shade is left at first by felling very few of the larger trees, the cost may be 20 per cent. less. In many instances where time has been unusually precious owing to a late commencement, I have seen forest land planted out very rapidly by cutting down little besides the mere underwood, and setting fire to that; and after felling some of the large trees the ground was staked out and the seed sown out, after a little patch by each stake had been hoed to receive it. But only necessity could justify such a manner of working as this. Especial care should be taken that the hoeing is deep and thorough, and for about a foot all round the seed all such small roots, creepers, &c., as may be removed in practicable working time should be taken out, and large stumps, if they are near the stakes should be uprooted, for sooner or later, they are sure to cause harm to the plants.

Grass land, as is apparent, is much easier to get under cultivation than forest; but it requires much more hoeing and attention than the latter for the first year or two, or indeed until such time as the original grass can be eradicated or got so well under hand as to cause little trouble.

A very common way is, after setting fire to the grass, to give an ordinary deep hoeing and stake the ground off, and then for about a foot on each side of the stake to take out as many of the grass roots as possible before sowing the seed. If seed is to be planted out, however, I should prefer to plough the land thoroughly after deep hoeing, and then rake up the roots and burn them. The best mode of planting out in grass

land is, I believe, from nurseries with six months' seedlings in the rains and always, if possible, on cloudy or rainy days. I prefer taking up earth with the seedlings for this purpose, and if care is taken to have the land round the stakes tolerably free from grass roots, the rest of the land may be turned up in very large clods which should remain unbroken, and light hoeing should be then given as needed in the usual way. If the seedlings are vigorous when lifted from the nursery, my experience is that better one year seedlings will be obtained by such transplantation than by seed sown at stake in grass land, and there will be fewer vacancies; very young seedlings from seed *sown out* in grass land standing a much poorer chance of life than those sown out in forest. The planter will act wisely in giving no fixed nirrikh to laborers planting out seed or transplanting seedlings, but merely see that the hands keep steadily at work, and take care that the work is done *thoroughly*, whether rapidly or slowly got through. But I consider it absolutely necessary for him to make very frequent measurements of the land in course of clearing. He will do this best with the chain, which is far more trustworthy than the null or tarr; and in all his calculations in dealing with rough land let him always *under-estimate*, for the appearance of half cleared jungle is very deceptive as to the actual area.

Supposing the seedlings well up, we now come to cultivation in its particular and technical sense, which is that of keeping planted land in the most favorable condition for the plant's growth; and to commence with a garden of seedlings it may be confidently said that this cannot be kept too clean, and not a weed should be allowed a week's life, but the whole strength of the soil should be for the seedlings only. If the weeds be dealt with from the first they may, in good forest land, be taken up for the whole of the first year by hand, and by keeping a number of women and children incessantly at them they will never be able to make head; while the work as regards the young plants will be much more beneficial than hoeing,

and it will cost less money. Of course the weeds must be eradicated, and not broken off above ground, and with young weeds in good loose forest soil this can be easily done. I know one planter who worked on this plan on 50 acres just after sowing them out. The land was good forest, and had been well hoed in the first instance, and the hand weeding throughout the seed was a perfect success. I never saw land in such uniformly good order nor plants that derived more vigor from well kept land ; and the best of it was that as the weeds were always uprooted, they lost their power over the ground, and the garden required very little light hoeing during the succeeding rains, and much of the work was again done by hand. I have tried the same plan with success myself, and the cost was about as follows :

	Rs.	A.	P.
A woman did on an average 25 nulls of 12 feet square per diem, consequently as nearly as possible, twelve women would do an acre in a day, and their pay being rupees four per mensem would bring the cost to per acre ...	1	9	7

or nearly a rupee less than the cost of ordinary light hoeing. It must be admitted that under good forest shade for the first year the growth of jungle is always very light as a rule ; but on the other hand I have had the work done in some cases at 40 *nulls* per woman, which is at the rate of a rupee per acre, and by keeping them steadily at such work as the result of their labour tells, the nirrikh can be increased without any objection on their part. Where there is very little shade, or in grass land, this mode of working will be scarcely practicable, as the advance of the weeds and more formidable grass will be too rapid, and in the cases of the grass the task would be altogether too difficult. Neither could the plan be so well carried out on stiff clayey soil even if under forest shade, although it would not be impracticable. During the season, say from the beginning of March to the end of October if each

acre is weeded in this way seven times, that will certainly be an ample allowance, and six times will generally be found quite enough. This would make the cost per acre under ten rupees—nine rupees nine annas actually, but as I have remarked the nirrikh could be often increased and the work would then cost less. If imported labour is employed, one-sixth *more* would have to be *added*, for it should be borne in mind in making any estimate of the cost of work to be done by this means that imported coolies have their *Sundays* allowed them for rest, and that out of every seven days for which they are paid, they only work on six. I would make another remark by the way to the effect that if the planter is not thoroughly sure of getting plenty of local laborers to keep his seedlings clean, he will act wisely if he has his imported laborers domiciled in his garden ere these seedlings make their appearance above ground. By doing this he will ensure a fair start for coolies and seedlings both, and he will not have cause, with ordinary good fortune, to regret this; although he will regret if he trusts to luck to get through the first year without the necessity of importing, or, if seeing his mistake rather too late, he seeks to rectify matters by importing during the rains. These remarks of course are without force in the Himalayan districts, but not so in Assam and Cachar, and I believe (though I regret to hear it) in Chittagong.

For commencements on grass land, I have indicated my preference for transplantation in the rains, and if this is begun say in the beginning of June, the land being turned up in large clods, and staked off, then most probably four light hoeings will be needed ere the cold weather sets in, say one in the middle of July, the second in the middle of August, a third in the middle of September, and the last about the end of October. It may be possible to do without this last, but not generally, and these four hoeings would not cost less than two rupees eight annas each per acre, a man doing 20 turrs o

"scamped" work may be usually detected by the absence of this soft loose earth among and over the clods. If these latter are lying in great square lumps with plenty of empty space at the corners between them, a little probing with a stout stick will prove, although the appearance of the hoeing may be excellent, the work has not been properly done. Deep hoeing should invariably be tested in this way, and the depth should be about a foot *straight* down, though neglected land will need two or three inches more.

Deep hoeing is of little use in freeing the soil of grass roots and weeds permanently, but it can indirectly assist the task of eradication by exposing the roots for that purpose. This last mentioned branch of cultivation deserves a few special remarks. *Eradication* of weeds can, in my opinion, be looked on only as an adjunct to hoeing, and indeed I consider it only really necessary where grass in its several varieties such as *sun grass, ooloo, dhaub,* &c., has got such a hold on the soil and mastery of the surface as to be positively injurious to the plant. The views held by some theorists as to its entire adoption to the exclusion of light hoeing I regard as Utopian, for they could only be put into practice on new land for a year or two, or if on old cutivated land, then only on a very small scale. They could never be carried out on a large garden of any age, for the work would necessarily have to be done very slowly, and the chances are that the length of time ere the laborers could come round again to a given spot would be so long as to neutralise the benefit that seemed apparent at first. It is not possible to effect a thorough eradication at one or two operations, and the roots that remained would have such ample time to themselves ere their turn came round, that their produce would probably be quite as great as that of unweeded land hoed at a shorter interval. The probability is that no planter could systematically have a garden of even moderate area kept clean for a whole year by hand weeding, as the heavy rains and strong sun of the warmer months would soon

drive him to the hoe. That heavy grass should be taken out of the soil to as great an extent as may be practicable is a settled conviction with me; and wherever it afflicts a garden, the manager should determine to destroy as much of it as he can. This he will be best able to do in the cold season, and after the land has been deep hoed. Women and children can do this work very well by breaking the clods with short heavy sticks and extricating the roots from them and from as much of the under earth as they can manage to get hold of. The roots being heaped together should then be burnt. In the Dehra Dhoon where *dhaub* grass (which is worse in my estimation than the *ooloo* grass of Assam) is very troublesome, we find the hot weather which lasts from the end of April to the end of June, a very suitable time for this work. The garden which I am managing has suffered much from *dhaub* and last hot weather I employed every available laborer in the work of eradicating it in the manner mentioned. I had taken over charge of the estate, but a short time previously, and being curious to learn the extent to which this *dhaub* had penetrated, I had several holes dug where it grew thickest, and I found that in parts it was to be found at the depth of *five feet.* I did some of the worst places twice over, and after keeping these steadily in good cultivation by light hoeing during the rains, I have the satisfaction of seeing a fair quantity of *dhoob* mingled with the small and greatly scattered shoots of *dhaub.* I hope that after I shall have again weeded these spots and similarly hoed them, the surface will shew the former healthy and harmless grass only.. This I think is a good instance of what hand weeding can effect, and shows its good uses *in conjunction with hoeing.* If, however, I had attempted to have cultivated my garden solely by the former means, I should have attempted an impossibility, for I could never have carried on the work when the rains came on; but even supposing that I had been able to get over the garden once after their setting in, the task would have been so difficult, and therefore

so long of accomplishment, that the parts first done would have been covered with grass of quite the original power of growth ere the people could have got round to them again. The argument of the advocates of weeding is I believe this—"What is the use of hoeing land when this has to be done "incessantly? Why not rather eradicate the weeds and have "done with it, or at all events, greatly lessen the cost of "cultivation."

To this I would answer, that land subject to powerful climatic influences will always grow weed, and that permanent prevention is impossible; and that therefore those who support the theory of weeding seek an unattainable result; further, that the tendency to grow weeds can be only successfully resisted by frequent periodical culture, which cannot practically be given by weeding, from the slowness of the operation, but which must be sought for in hoeing or some other means at least equally rapid, and that the true uses of weeding are to assist such a mode of cultivation, not to supplant it.

It should be remembered, too, that frequent hoeing will of itself render the work of cultivation progressively less difficult, and will change the character of surface jungle and grasses for the better; and I would remark, although no one can be a more strenuous advocate than myself, for the removal of the sharp and ooloo grasses from the soil, yet with the harmless weeds to be found in a garden under ordinary good cultivation, I would be inclined to adopt an entirely different plan to that of eradication by weeding, and would on the score of cheapness and efficacy of result prefer to *bury* them. I first saw this done by an experienced planter from Cachar, who told me that he had followed it for years there with success, and on trying it myself I quite agreed with him. But to succeed in this method the growth should be only such as can be correctly characterised as *weeds*, and there should be no *dhaub* or *ooloo* among it; nor will it be practicable unless

the height of them is about eighteen inches or under. A lower nirrikh will have to be given, say 4 nulls less, and the weeds should be buried at distances of a null apart, not deep, but just so that the earth covers them effectually. My experience was that land so treated kept clean half as long again, and as I found that the buried weeds become perfectly rotten underneath, I could not differ with my friend in his belief that they enriched the ground.* In the cold weather, when deep hoeing, not the least trouble was experienced, as the buried weeds seemed to have become perfectly rotten and mixed with the soil. The only difficulty I found was in the length of time taken in doing it to the decrease in the nirrikh. Having given my reasons for the belief that deep hoeing is a necessary branch of cultivation, and that its proper time of application is the cold weather; and having expressed my disbelief in weeding as the means of culture during the rest of the year, I must now treat of what other means should then be employed, and what its cost should be.

Light hoeing is in general usage, and I believe nothing is better. It may consist either of giving *one stroke* with the hoe and turning over a clod, or of merely scraping the surface; and where the weeds or light jungle are of any thickness of growth, I believe the latter way is the better, especially in rainy weather, because cleaner work is made, and as the roots of such weeds are generally close to the surface, the hoe in scraping takes them quite out of the ground and the weed withers, while by turning up a clod, the weed, root and all, is merely thrown on one side or turned up uninjured, and in such favorable weather for its growth it recovers very rapidly, being in fact only roughly transplanted. But if the weeds are neither very thick nor high, good work can be made by giving one stroke and then another on the clod, which last blow knocks

* The use of green crops as a manure is one of the axioms of husbandry. They contain much saccharine matter and readily ferment, requiring no preparation to fit them for manure, and indeed cannot be applied too soon.

the earth free of the roots, and this is light hoeing in its strict sense. Twenty nulls of 12 feet is the general nirrikh, and at this, it costs Rs. 2-8 per acre.

Assuming that a garden of plants over the third year has had a good deep hoeing in the cold weather, how many light hoeings in addition will constitute proper cultivation during the succeeding season? In the first place, land so deep hoed will remain sufficiently free of weeds till the middle of March, when it will require to be freed of them by light hoeing—say then this is done (although in practice in Assam this period is such a busy one with the plucking of the first flushes that the land seldom gets hoed until the beginning of the following month) at the estimated cost of Rs. 2-8. The time at which this will require to be repeated is ordinarily six weeks, but in some gardens it is never done under intervals of two months, which system I cannot however consider *cultivation.* Six weeks is sufficiently long for any land to lie unless weeding has followed deep hoeing, in which case the first light hoeing might not be necessary for a full month more, or say at the end of April. Giving six weeks as the period, then the hoeings would succeed as follows:—

			Date
First light hoeing commences			20th of March.
Second	ditto	ditto	3rd of May.
Third	ditto	ditto	15th of June.
Fourth	ditto	ditto	31st of July.
Fifth	ditto	ditto	20th of September.

Periodical light hoeing at these dates would constitute very good cultivation, and a sixth light hoeing should not ordinarily be required before the cold weather hoeing. In many gardens, as I have remarked, two months lapse between the hoeings, but this is most frequently from necessity not from choice.* I give these dates as the usual periods, and the cost

* The hoeing between April and June is often unnecessary, and if is scarce, can generally be omitted without detriment.

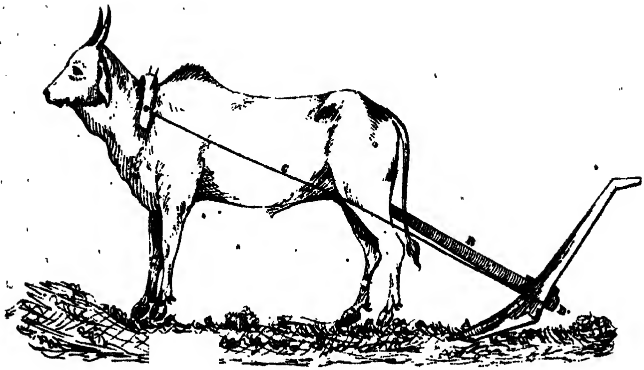
would be at Rs. 2-8 per acre Rs. 12-8, which, with the deep hoeing Rs. 5, would give Rs. 17-8 per acre per season, *plus* one-seventh if done by imported labor, and on the assumption that the coolies' wages are Rs. 5 per mensem.

The effect of a thorough hand weeding would probably be to render light hoeing unnecessary until the middle of June and thus the first two hoeings might be saved, and as the weeding itself would be done for Rs. 4, (not for *less* if done *well,*) this would effect a saving of one rupee per acre, and the growth after the light hoeing then given would probably be lighter, although I could not go the length of saying that another light hoeing could be saved between the 15th of June and the cold weather. To weed after this light hoeing would probably obviate the necessity of one, and the weeding would not require to be done so thoroughly, and would cost less than the cold weather work; but there is no garden that at such a season could afford to employ women and children on such work, while to set men to it would just be to endanger the possibility of plucking leaf by the rapid growth of jungle as against the means employed to keep it down, *viz.*, weeding. In all gardens, however, it is most probable that the women and children would have their hands empty in February or from January, and I should think they could not be better employed than in weeding or rather in eradication of jungle roots from the deep hoed land, as the result would in any case be beneficial to the soil and might save more than I have estimated above, although I cannot see how myself; but a rupee an acre is not to be despised, and the benefit to the soil by freedom from noxious grass roots would mean decided benefit to the plant. In the Dehra Dhoon after the deep hoeing a light hoeing is usually given in the spring, though this is sometimes dispensed with, but it is better to give it; and where *dhaub* infests a garden, the hot weather should be taken advantage of to eradicate it. This is peculiarly necessary here where the actual manufacturing season is very short, extending from

July to October, and during which time it is generally as much as can be done to gather the leaf and make the tea in the scanty time available; while at this period the *dhaub* grows a-pace, with a rapidity that I never saw equalled in Assam. It is therefore wise policy to get the land, while there is opportunity, into a condition to need as little cultivation as may be at a time when labor can be ill-afforded for that work.

The fact is indisputable, however, that to hoe land you must have labour, and as that has been for long a dear and scarce commodity in the importing countries, and often is a scarce commodity anywhere, efforts have been made to attain this result by other means. I do not believe that there is any way of cultivating land to equal hoeing: weeding is more thorough, but it is impracticable, and is I believe often undesirable; and the only other way that I know of is *ploughing*, which is only possible in a tea garden under modified conditions as compared with ordinary ploughing either at home or in India, and which, after a good deal of experience, I can only consider as a somewhat indifferent substitute at the best. That it can be made a substitute is, however, a great thing, and in some quarter it is held in high favor, and I believe actually in preference over light hoeing. I shall proceed to state my experience of it. To begin with, I consider ploughing is only suitable for the cultivation of light soils, or soils of a very porous nature, or which have the advantage of good natural drainage. It is not at all well adapted for stiff clayey, or low lying land, for the reason that its operation will in the rains churn these to the consistency of paddy land at the rice transplanting season, and leave them of an iron-like hardness afterwards. It will have a very hardening effect on *any* soil, but not to a detrimental degree on those of the first-mentioned characters, and the cold weather deep hoeing will put that right again. To be worked to the best advantage, ploughing should begin before the weeds get any start after the cold weather hoeing, and the ploughs should be

kept continuously going all throughout the season, and if this be done, very good work indeed may be made, and the weeds will be well kept under if care is exercised that the work is fairly done. On most soils it may be found advisable to suspend operations for a short time at the period of very heavy rain-fall, as unless the soil have great facilities of drainage, the plough will tend to make the land slushy, and in low places the continual treading of the bullocks will make mucky puddles. After two days of fair weather they can be put on again. For lines of tea bushes, planted six feet apart, five ploughs will be best, but four may do; for five feet lines, again, four ploughs should be used; for four feet lines three, and in the same ratio two ploughs will suffice for three feet lines. As may be surmised by those who have not seen the work, it is impracticable to use *two* bullocks to a plough, the width of the widest lines preventing this, to say nothing of the damage that would be done to the bushes by the usual arrangement. One bullock therefore is only yoked, and the plough itself is of much smaller width and bulk than the ordinary cultivation plough. But it is important to bear in mind that no "patent" or Europe-made implement should be used, but one made of the ordinary materials of the country and of the simplest constructions; for they are continually getting out of order, but the latter kind can be at once repaired by the ploughmen themselves, and at the most trifling expense, which would not be the case, by any means, with the others. The construction of the plough is just that of the common native one, but the share is narrower and



(Cultivation.)

Fig. 1.

A.—Ploughshare (of iron.)

B.—Bamboo pole.

C.—Rope.

D.—Peg to which the rope is fastened.

N. B.—Both ploughshare and pole are, of course, easily moveable, and can be adjusted as required.

a single bamboo only goes from it upwards as the pole. The yoke or collar is of wood, kept in its place on the neck by the usual plan of two wooden pegs through it. The pole is of course at one side of the bullock and a rope should be at the other, this to be kept clear of the bullock's heel by a small piece of wood, a foot long, projecting from the plough. I give a rough sketch of a plough of the kind, fig. 1, but such is almost unnecessary, for any country mistree can make one without any plan. I am using a single plough of the

kind used in the North-West Provinces, and although it differs considerably in shape from what I used in Assam, it does equally well—in short any country plough adapted to suit one bullock will answer the purpose capitally. The ploughing iron should be cut across at the end, and should never be *pointed*, as it would in that shape be apt to cut through the roots or through the stem of a bush. The mode of working is this, the first bullock goes to the extreme left of the space between the lines of bushes and commences to plough the first furrow, the second plough makes its furrow close to the first, and immediately to the right of it, and so on, till the furrow reach the opposite or right side of bushes. I have mentioned that the bullock's feet are kept free by means of a projecting piece of wood, and it may be thought that this projection by catching in the bushes would injure them and retard the work; but to avoid this the poles of the plough are used in the opposite sides of the hindmost bullocks, and thus the projecting part of the plough all point inwards—thus if the poles are on the left side of the bullock, then the smooth surface of these poles alone can be in contact with the bushes and will never harm them, and of course the projections point to the right, but are far from the right hand bushes. This is for the first two. The second couple have the smooth pole to the *right*, next to the right hand row, and the projections point to the left.

The ploughmen are sure to make objections to this arrangement at first, and to declare that it will not do, but a trial of a few hours will convince even these hereditary conservatives. The plough should be made to go very slowly, as better work will be done as regard the soil, and there will be less likelihood of accidents to the plants. The bullocks will probably be very unruly at first, but after a week's practice they should go very steadily, and with proper care I have never had reason to complain of injured bushes to any thing more than a very trifling degree. I have never used the

plough among bushes that were so close as to be touching, but have seen several gardens where fields covered with bushes of these dimensions had been ploughed; and although I was at first incredulous as to the possibility of ploughing such land, on inspection I found that it was well turned up, and there was scarcely a single broken branch, and these few were at the turning points. The planter in this case had not at first thought it would be practicable to plough these closely covered fields, but as it was a question of ploughing or suffering them to go into jungle, he chose the former alternative, and had every reason, he assured me, for satisfaction that he had done so. It should be noticed that the plough should be turned as seldom as may be, and should be kept going in a straight line as far as is possible, as it is at the turning points that damage is apt to be done to the bushes.

Land is usually considered to be ploughed sufficiently for one time when it is done twice, once say from north to south and again from east to west, and three good bullocks can go an acre in one direction in a day; but as it has to be done again, half an acre would be the area that three ploughs should be able to get over per diem.

Assuming the ploughman's wages to be Rs. 5 per mensem, then six men's labor would be employed per acre, which would give a cost of exactly one rupee per acre, and it will not be found to exceed this. There is, however, the after cleaning of the bushes to be taken into consideration, for the space immediately under and round the bush is, as will be evident, left pretty much untouched by the plough. Three men with the hoe will, if they work properly, be quite sufficient to clean the plants per acre, and ordinarily two will suffice, or four women can hand weed this area. This would bring the cost to about 1-6 to 1-8 per acre, and my ploughing this season was done at slightly under that, and I believe that the work can be fairly done for the latter figure. Unless the ploughs are used from the first of the season they will not

make good work : they will indeed *break down* heavy grass and jungle, but the result will be very inferior to hoeing; and it will be found a difficult matter in such circumstances to clean the bushes. It will be very evident that ploughing can compare very favorably with light hoeing on the score of cheapness, and even this is not such a point with its advocates as the saving of labor, for, whereas in ploughing six men do an acre well, it requires fifteen men, working at twenty nulls each, to accomplish the same work, and is *with much* more *hardship*, which last consideration is no light one when imported coolies are employed. Those who use ploughing from necessity are often satisfied if they can keep their bushes sufficiently free of jungle to allow of their being plucked, and in many cases accomplish their work more rapidly than at the rate of six ploughs per acre, but of course the work is very roughly got over. It is *only* in cheapness, and in this saving of labor that ploughing is at all to be compared with hoeing. This is at least what my experience has taught me, and I know that I am not alone in holding this view. I am aware that its advocates insist that it *stimulates* the soil even more than light hoeing, but this view I believe to be illusory, and I think its invariable tendency is to stiffen the soil and make it extremely hard. The action of the plough is very shallow, and it never penetrates more than a couple of inches, nor, being intended simply as a surface cleaner, is it meant to penetrate deeper; indeed two inches is an extreme depth for it, and it in scraping along seldom exceedes *one* inch; and it is not easy to think that this superficial scratching can have great stimulating power, while the treading of the bullocks first makes the soil mucky, with a tendency to stiffen like iron in the sun, and steadily hardens it to a degree that makes the work of deep hoeing ploughed land perceptibly more difficult than that of ordinary land that has been light hoed in the usual way.

The weeds spring up again, moreover, more rapidly than after light hoeing, the reason being that the roots are not exposed efficiently to wither, but remain more among the earth, and more ploughings in a field would be needed than light hoeings. Assuming that the work is commenced about the end of March, I think that it would be necessary to give the land fully six ploughings during the season, that is until the middle of October, and seven times is the more likely number. This at 1-8 per acre would cost Rupees 9, for six ploughings which, with Rs. 5 for the deep hoeing, would make Rupees 14, as against Rupees 17-8 for land done with the hoe, so that the saving is actually far less than most people imagine, the gereral idea being that the work can be done for half the cost; if however, in addition, the purchase of cattle is taken into account, the cost, however slight of plough, and the loss by wear and tear, I fancy there will not be so very much difference between the actual *monetary* cost of the two methods, the great and appreciable saving being in the *labour.* On the whole I must again repeat my belief that ploughing is an inferior substitute for hoeing, but still it is a great thing in these times to have any substitute that will do, and I certainly think it is very deserving of more careful and general trial than it seems to have had: at present indeed it is supported far too warmly by some, and regarded with too bigoted prejudice by others. I intend to use it much more generally in future than I have done hitherto, one reason being that the soil and position of my garden are both favourable. The best bullocks for planters in Assam known in Bengal are the Rungpore breed: they are much preferable to the larger animals known as Patna bullocks. The ordinary bullock of the North-West does admirably. In conclusion on this subject I would just remark that the planter must not get alarmed at the sight of a few broken branches during the first week, as the animals will soon go very steadily; probably

it will be better to allow a lad to lead the foremost one of a team, but only for a few days, or an unnecessary excess of expenditure will be the result. In Assam the bullocks are worked from sun-rise until about eleven o'clock, but not so late in the hotter months. In the Dhoon I have worked them twice a day, resting them during the extreme heat without any harm accruing to them.

To sum up the whole of these remarks to a practical conclusion, I would say that all lands under tea-cultivation should be well deep hoed in the cold season; *secondly*, that wherever *dhaub, oloo, borotta*, or sun grasses infest a garden, no effort should be spared to thoroughly eradicate them, if for no other reason than that they are directly injurious to the roots of the bushes; *thirdly*, that from March to the 1st of November, the land should be light hoed at periods which should not be of greater frequency than once every six weeks, which interval however should not be much prolonged; and the bare cost of which light hoeing should either ways, at Rupees 5 per mensem, be not exceeding Rupees 13 or Rupees 18 with the cold weather hoeing (this *exclusion* of one-seventh more for Sundays); *fourthly*, that wherever labour is scarce, or where imported laborers are sickly, ploughing should be adopted in the place of light hoeing; and, *lastly*, that *every one* should give ploughing a long, fair and carefully-watched trial, with a view to its more general adoption as an economical mode of culture.

In finishing this subject I would mention that where grass may be found to be giving serious trouble and where it can not be kept under with sufficient rapidity by the hoe, a very efficacious plan is to *cut it*, just as thatching-grass is cut and with the same sort of knives. The ground will not, as a matter of course, be benefited: but where labor is short and the main point is to keep the bushes clear for plucking, I recommend this way of gaining that point. A man can cut in this way more than twice the quantity that he can

light hoe, and it will be found that the grass comes up *very slowly* afterwards, although it must be admitted *more thickly.* However it is an admirable "make-shift," and I kept the greater part of my garden clean last rains by means of it. My coolies were much affected by sickness and I had only a few ploughs, but by cutting the grass I managed to keep the place clean, and the bushes in capital order, with certainly little more than half the number of hands that would have been needed for light hoeing, and with the advantage that the easier work suited the weakly state of the men. I gave a nirrikh of 180 single lines of 5 feet by 5, which equalled 4,500 square feet, which light hoeing nirrikh of 20 nulls of 12 feet is 2,880 square feet. But for the disadvantage of thicker growth of grass, I should really consider this way of treating a garden in the rains as good as any, as it is certainly one of the cheapest. With the lighter weeds I have not marked this increase so much, however, and I certainly shall always have recourse to the plan again under similar circumstances.

Manure and the effects of its use.

The importance of the proper application of manure in tea cultivation can scarcely be over-rated. Manures are just as valuable in this as in all other varieties of cultivation.

By their use a poor soil may gradually be brought to the level of a naturally fertile one, and a soil already rich may be made to yield yet more abundantly.

Planters who have not been blessed with soil of the latter description have long given the subject their attention—those who *have been* working on such soil have not, on the contrary, given it much thought, nor has there been much necessity; but as even the richest natural soils may after the lapse of a few years be benefited materially by manure, its use must undoubtedly become general, and it will attain a prominence of consideration which has not hitherto been accorded to it. A few general remarks on the nature of manures may not be out

of place here.

The great active and essential principle in manures is nitrogen. The value of different manures varies nearly in proportion to the amount of nitrogen they contain.

This element is to be found in all manures, even of the most different kinds, fish, woollen rags, or shoddy or horn-shavings, sea weed, rape-cake, &c., which all agree in containing undeveloped nitrogen. Many of them indeed contain far too much for any purpose of the tea planter, but to shew the importance of it, its presence in Peruvian Guano may be cited. This manure has its pre-eminence solely to its large percentage of nitrogen which renders *one ton* of it equal to—

33½	tons of	farm-yard dung.
21	„	horse dung.
38½	„	cow-dung.
22½	„	pig dung.
*14½	„	mixed human excrements.

Whether Guano would be suitable as a manure for tea or not is a point that has not, to my knowledge, been tested, but I intend to make the experiment, as it is difficult to get any adequate quantity of ordinary manure in one season. In Europe, Guano is not applied alone, but is mixed with five or six times its weight of ashes or mould after being finely pulverized, and I presume that as great an admixture would have to be made here, if indeed the power would not have to be even more weakened.

The practical question for the tea planter is, however, "what manures are easily obtainable for any use?" Admitted the superiority of many manures used at home, the cost of importing them would, in most instances, cut up any profit derivable from their employment.

But there are at hand many efficient substances, which are probably as well adapted for tea as any foreign ones.

* J. C. Nesbit.

Cow-dung, farm-yard dung, *i. e.*, cow-dung, straw litter, &c., oil cake, both from the castor oil seed and tea seed, are all most suitable manures; and ordure, if arrangements could be made for its application, and if it were properly applied, would be found the most valuable of all.

As to what the effects of the use of manure are the answer lies in a sentence, "the effects are rapid, unmistakeable, and highly beneficial," and no one who has ever applied it and watched the result can have the slightest doubt on the matter. The only considerations that remain are *first*, how can a good supply be best ensured, and *secondly*, what is the best method of application?

The most common manure by far is cow-dung, that is there is usually more of it obtainable than of any other manuring substance. It is not, however, so patent as farm-yard dung, as the straw of the latter contains many additional principles which are wanting in cow-dung alone, and is particularly much richer in the valuable one of carbonate of ammonia. "Farm-yard dung contains within itself, not one alone, but *all* the ingredients which plants require for their nutrition, and what is perhaps of equal importance, existing in that state in which they are most readily taken in and assimilated by the vegetable organs."*

To consider ordinary manure first. Some erroneous impressions prevail about it, such as that fresh dung is powerless, that old black cold dung is the best, and that dung, no matter how kept or whence gathered, is always equally efficient. Fresh dung is a capital manure. We have only to look at a field where cattle have been grazing and notice the superior luxuriance of the grass at those places where dung has fallen to see this. A slight incipient fermentation is useful in all manure of this kind, but the danger is so great of loss of valuable matter that it is much better to let the fermentation take

* Dr. Daubeny.

place in the ground than to run any risk of loss in this way.

Dung that has been lying loosely scattered about villages for probably months beforehand must have lost much of its efficacy, if for no other reason than that the rain must have washed out many of its soluble fertilizing constituents.

Farm-yard dung is, as has been remarked, more potent than cow-dung, and as it only needs the addition of dry grass, paddy straw, &c., to make it in this country, it should always be employed in preference to cow-dung.

A fair degree of fermentation is very desirable with this manure, to decompose the great quantity of woody fibre, but care must be taken that it does not proceed too rapidly, as its effects on manure are like those of combustion on wood. Another thing to be remembered is that *straw* is *not* a good absorbent of manure, as is generally believed. On the contrary from its light porous nature it is one of the very *worst*, and when among dung loosely thrown together facilitates the passage of oxygen among the mass, producing an effect like that of fire among sticks lightly laid across each other.

Straw is chiefly useful in augmenting the *quantity* of manure and is a very handy and quite inexpensive material for this purpose, and when well mixed up with dung and urine will rapidly rot and become in conjunction very valuable.

Farm-yard manure in India, and especially at a tea factory, should always be collected *in-doors*, never outside. With large warm cattle sheds, which every garden should have, and with a large number of cattle, which, if for manure alone, every garden should likewise have, there can be no difficulty. The first thing to be done is to lay down good dry loose mould in the sheds. It is one of the best absorbents of urine by the agreement of the best and most practical authorities.

I lay earth down in my sheds to the depth of three inches and think this height is about the best. On the top of the earth lay down enough straw to allow the cattle to rest comfortably, and the beginning of a good stock of farm-yard

manure is made. The straw should be taken out every fortnight with the dung, and the earth at longer intervals, but this will much depend on the number of cattle in a shed. When there is a good proportion of dung, when the straw is dark-coloured, wet and matted, and the earth well moistened, all are ready for taking out to make room for a fresh supply of earth and straw.

Such manure should not be allowed to lie too long on the heap—there is not the least necessity for its remaining on the dunghill for a longer time than is required for the straw to rot. *It is much better to apply it prematurely,* than when mischief may have been done by *excessive fermentation* or by *careless exposure.* The floor of the cattle shed should be *pucka* if possible. This is no difficult matter to accomplish in the North-West where stone and *soorkee* are plentiful, but it would not be so easy a matter in Assam. However, the underlying dry earth (beneath the straw) will not allow much urine to be wasted.

For such manure as indicated, three months will, as a rule, be amply sufficient time for it to lie on the dunghill.

If circumstances require it to remain longer, care must be taken to *preserve* it, or rather to *preserve* its properties, and to this end some attention is necessary to the dunghill. This should be protected from the deteriorating effects of the sun and atmosphere as much as possible.

It is better to have it under a good substantial shed with walls. From the dunghill "nothing must be allowed to run away in the form of a fluid or to fly away in the disguise of a smell."* The base of it should be pucka and there should be a good covering of dry earth on the top of that so as to absorb any liquids that filtrate through the mass. When the internal heat exceeds 100° it is a pretty sure sign that mischief is going on by too rapid fermentation, and although

* Dr. Lindley in "The Gardener's Chronicle."

the cold external layers of the heap will to some degree "fix" the gases evolved, still it is much better to use such manure without delay, or to spread it out and cool it, if it is impossible to apply it at once.

The following plan which I am adopting myself will, I think, be found a suitable one for factory purposes. Have the manure pits 15 feet square, two together, thus forming two pits whose extreme length will be about 31, and breadth 15 feet. These will be very good dimensions for a shed, the roof of which should not be too high. The *North side* might advantageously be left unclosed, as the coolness of the aspect will be beneficial.

The bottom of the pits should be *pucka,* either brick-work or of stones and *soorkee.* This will prevent any wasteful drainage. The sides of the pits might advantageously be built in the same manner. The advantage of having two pits instead of one is that by having a wall in the middle of them the manure is less exposed to atmospheric influence, than if thrown about in a large space. This middle wall or partition should rise above the level of the pits by about 4 feet, and it will be found useful in banking the manure in each of the pits against it as the quantity increases and rises above the upper levels. From the top of the separating wall to the bottom of the pit, the depth will, of course, be 7 feet or thereabouts. This kind of pit will be found very suitable for manure that can be taken away within a short time of being stored, say within three months, and there is little wisdom in allowing farm-yard dung to lie longer if not inconvenient to remove it.

The base of the pit should be of good dry earth of as rich a kind as may be had on the estate, and should, if possible, not be sandy, otherwise it will not answer its purpose of receiving the filtrations of the upper mass so well.

The farm-yard dung should now be thrown in, always taking care that the proportion of dry straw be not great.

All straw should be stained and wet. Of course ashes or any other manure obtainable may be added. *Horse-dung* will add very rapidly to the fermentation of the mass, but it should be added in small proportions, as it is too heating in my opinion for the tea-bush. (Fresh horse-dung applied to a young plant will be apt to kill it outright.)

If any liquid manure can be thrown on the heap so much the better, and water may now and again be used, as it will assist the decomposition of the woody fibre. When on inspection the straw seems to be well advanced in decomposition, and looks black and rotten, the manure should be carted off, but too long time should not be allowed for this purpose, and the straw in the time indicated, generally speaking, *will be ready.*

For manure that has to accumulate for a much longer period, say during the whole or greater part of the ma[illegible] facturing season, another pit 40 feet long by 20 feet broad 2½ or 3 feet in depth, will be preferable, as rapid fermentati[illegible] is not wished for here, the object on the contrary being [illegible] retard it. The same basis of earth should be employe[illegible] the manure should be cooled when brought from the sheds prior to throwing in. At first this will not be necessary as by being thrown broadcast into the pit, it will cool in that way sufficiently.

When the manure has risen to the height of about 2 feet, a "fixer" must be employed. Provision has been already made against loss by leakage, and to catch what would otherwise fly away is the purpose of the "fixer." That this is necessary is proved by the facts of experiments having at various times been made with retorts filled with hot farm-yard litter, the beaks of which retorts *alone* were inserted among grass, and yet the effects produced upon the grass by the influence of the matter disengaged in fermentation were most distinct, causing it to grow with much greater luxuriance than the grass in any other part of the garden.' *Loudon.*

Manure.

Brick-dust, charcoal-dust, or clay, black mud, &c., are all good fixers. Layer after layer must be gone on with in this manner till the heap is complete. Water may now and again be added as the layers progress. If the dung has been properly cooled before being thrown in, or if it has had time to cool while loose in the pit, the temperature of such a heap should be under 100°, and there should be little danger of much loss of fertilizing matter.

I have seen liquid manure and urine applied with advantage to tea, but care must be taken with the latter agent. When fresh, it abounds in caustic ammonia which is very [illegible]udicial to vegetation, but if allowed to putrefy, the *caustic* [illegible]nia will be converted into carbonate of ammonia, and [illegible] manure will be mild and more valuable. Professor Spreg[illegible]el says, that urine which has been putrefying for a month [illegible]ontain[illegible] more than as much again of ammonia as urine in [illegible] state, and the ammonia is then in a combined and mil[illegible]. It is a fact [illegible] science that urine during the putrefactive process, if dilute[illegible] with water will lose no ammo[illegible] gas (which has a strong tendency to escape from urine [illegible] itself) and that double the quantity of ammoniacal liquor will be obtained. The earth from the cattle sheds if well saturated with urine and allowed to remain for a month or six weeks ere being applied, will be found a very good manure alone if used distinct from the other farm-yard substances.

Ashes are very good manure, but are more suited to clayey soils, for these they are the best, while liquid manures are found most beneficial on sandy soils.

The merits of the cake of the castor oil seed as a manure are very well known, and its application in tea planting is becoming very extensive. The Darjeeling planters bought up last year, I believe, all that was to be had at Allahabad; and I know of one concern in the North-West that could not be supplied for this reason, and this shews that its use

is well recognised in the former district.

I have seen it used this year, and with very perceptible benefit. The plant will grow almost any where, and would fill up any vacant spaces admirably; it requires very little attention, and as the oil is easily saleable and the refuse so valuable, I think every garden ought to grow it extensively.

The cake of tea seed I have never yet tried nor have I seen it tried, but where there was a large amount of seed and no chance of a sale, the cake might be applied, and it must undoubtedly possess many good properties.

Wood ashes form another very well known manure. They are very much better adapted for stiff and tenacious than for lighter descriptions of soil. If heavy soils like the former, they have a powerful tonic action, and much improve their consistency.

The surprising effects of ashes in some cases of blight must be well known to many planters.

In 1867 some parts of a garden under my charge in Assam became much affected by mildew, the upper leaves and shoots turning first white, and then withering off. I learnt the remedy from a friend, and by his advice I applied about 6 seers weight of ashes to each bush, mixing them well up with the soil, and in a very few days all signs of the evil had disappeared. I subsequently tried the remedy with the same good result at another period.

The mud at the bottom of old tanks (chiefly met with in Assam) is an admirable compost, and peculiarly adapted for light, sandy soil, as conversely ashes, &c., are best fitted for soils of a clayey nature.

The dung of sheep and goats is good manure, and is more rapid, though less permanent in its effects than farm-yard dung.

Green weeds, &c., form good manure, and undoubtedly benefit the soil, * affording much saccharine matter, but they

* See Cultivation.

should not be allowed to *wither*, otherwise the dry fibre will require to be fermented; they should be applied immediately after cutting.

There is of course a great variety of other manures such as soot, rags, bones, &c., but as these are out of the planter's reach practically, there is no object in doing more than allude to them.

As to the quantity to be applied to each bush, my opinion is, that if a good deal is not given, it is better not to manure at all. Great expense may be gone to in collecting and carrying, &c., and yet the quantity allotted to each plant may be so small as to yield but a minute degree of good, and in such cases the time, trouble, and money may be indeed said to be thrown away, while hope will only result in disappointment.

I consider that 8 seers is the *minimum* (of farm-yard dung, cow-dung, &c.), quantity to apply, and large bushes should have 10 seers.

It would appear almost self-evident that three or four seers can do no good to a plant, or at most will benefit it but little, but I had frequently seen a 10 seers basket divided among three bushes.

The manure should be laid all round the bush at a little distance from the main stem, say eight inches. It is not good to put it closer, as white-ants and other vermin may be attracted. It should be laid four or five inches below the surface and should be at once covered up. A common way is to lay all the quantity allotted to each bush in a hole at *one* side of it, but I find bushes do better with it applied all round.

The spongioles of the roots *all* seek nourishment, but by the latter plan of application those nearest the lump may be surfeited and poisoned by excess, while the others are starving.

As regards the *cost* of manure, it can be bought in the Dhoon

at about three annas per hackery load of cow-dung, which is ordinarily equal to 12 maunds. This is at the rate of a piece a maund, but if obtained from the cattle on an estate, it would not cost nearly so much. If we take an acre sown at 5 × 5 feet, and without vacancies, containing from 1,740 to 1,750 bushes; then at 8 seers per bush, 350 maunds would be required.

The cost at the above rate would be in this case Rs. 5-7-6. In addition to this there is cartage, and if the manure were purchased within such an easy distance as to allow of a hackery bringing four loads per diem, at 8 annas for hackery-hire, or 2 annas for each load, the expense of cartage per acre would be Rs. 3-10-4, or for the manure at the field Rs. 9-1-10 per acre.

A very common way, however, is, when the manure is at a considerable distance, to engage carts at the rate of 8 annas a day, on condition of their owners bringing a load of manure for nothing, but in such cases only the one load is brought and its cost is therefore exactly the hire of the hackery, eight annas, which at the quantity calculated would make the cost per acre for a 5 by 5 feet field, about Rs. 14-8; and it certainly would pay to purchase even at that high figure, although it is needless to point out how great the expense would be as compared with manure obtained from plantation cattle (many of them at the same time profitably employed) and carted by plantation hackeries from sheds or pits adjoining the cultivation. The cost of laying down manure in the Dhoon is, working with children whose wages range from Rs. 2 to Rs. 3 per mensem, about Rs. 2-8 per acre. If the bushes are very large and close together, the work is harder, and, of course, dearer.

Labor, management of, with details as to apportioning of work. Payments and Advances.

Local labor is, of course, much more to be desired than labor that has to be procured from other and distant parts of

India, but except in the sparsely planted Himalayan districts, laborers cannot be got in any sufficient numbers in the tea provinces, and the stream of immigration flows to them steadily.

The immunity from responsibility and trouble enjoyed by a planter in a district well supplied with local labor as compared to the extra duties of his *confrere* in a district without this advantage is very marked, but such supply must be certain and serviceable, otherwise the latter planter, with perhaps a good healthy batch of imported coolies, is decidedly in the better position.

In Assam local labor is tolerably well obtainable in the cold weather, but the men will not hoe in the rains, preferring to cultivate their own lands, and tea-makers are the only hands to be got. For the calling of tea makers it must be said that the Assamese is very competent, being quick and handy in his ways as compared with Bengalees, while in regard to working with cane and bamboo, he is as much more skilful than the latter, as a Chinaman, again, is than he. It has been customary to seek greatly for contract work from local people, but unless this can be done at very slightly increased rates, I do not see the advantage of it; tea will not bear any high-priced work now-a-days, and there is usually the necessity of making an advance, with the corresponding uncertainty of its being fully realized, or of the work being done at the requisite period even if the money be safe. It must be well known to all planters how much contractors require to be looked after, and what an inveterate tendency there is to "scamp" the work. Unless with my trustworthy people (and they are rarities among natives) I am very much against contract work in a garden, as the native will seldom believe or choose to imagine that his interests are in any way identical with his employers: he considers them antagonistic, and unless closely watched will win the game, the more especially if he is what we may term a master-contractor with coolies under him.

I would confine the application of those remarks entirely to *work* done, such as hoeing, clearing, building, &c., for as regards things that can be purchased, I think the less a factory makes from its own resources the better. In the latter case the article, say a tea-chest or a plucking-basket, for example, is seen and can be thoroughly valued at its true worth, while the price is fixed and defined, and if it is a fair one, the planter should know that the great chances are that it will cost him every whit as much without the cost being so accurately known. Leaf-plucking, too, should always be done as much as possible by contract, for there is no danger of cheating, and the perpetrators of bad work can be quickly brought to a lively sense of duty.

Without going deeply into the subject of imported labor, as that can scarcely be expected to be treated very fully here (nor with the many publications extant is it really necessary to do so,) I would give a few notes from my own experience on the more important points.

From what I have seen since I have been in the North-West, I think that *kutcha* bricks might be very advantageously used in the building of the huts. They would give a far more substantial and warmer dwelling, and the cost, I feel sure, would not be incommensurate with the great advantages. Mud walls would I think be far better than the present *ekora* and plaster ones, if *kutcha* brick be not used. At nearly every factory what is known in Assam as *alootiya máti* or clayey earth, is to be obtained in some of the jouns, or at some parts of the estate, and I have repeatedly seen far less suitable earth used here. After the earth is worked up to the right consistency, the bricks can be very rapidly turned out with a brick mould, and I am certain that numbers of the imported laborers would be found to be well acquainted with the work on enquiry being made. All these bricks need is drying in the sun, and then they are ready, but they should be covered up with straw till wanted. No lime is needed, nor mortar as

usually made, all that is necessary is some of the same earth made of the consistency of mortar and plastered on, and you have *kutcha-pucka*. This will last for years, and indeed is for all purposes quite as substantial as *pucka* brick, the only precaution necessary being to guard it from the action of rain *vertically*, and therefore all walls outlying a building, should have a cover something like a small *chopper* of grass on top to protect them. But this is not necessary in the case of hut walls or house walls, generally, as they are well enough protected by the roof. Only the walls need be of *kutcha-pucka* as the centre posts could be of wood as at present.

I have always had a preference for building the coolie lines in the form of a square with a large space in the centre, or better still in three sides of a square with the other open to the prevailing wind. By this method the lines can be very easily inspected; and cheerfulness, from the large concourse of people with plenty of room to move about in, is greatly promoted, as numbers of the coolies will meet in the square to amuse themselves when off work, to talk and smoke, &c. There is, moreover, less danger from fire than in lines formed of two close rows of houses, and it can be extinguished more readily because so rapidly perceived, and because of the space available for working in; while coolies in houses arranged in this manner have much less to fear from infectious diseases.

If possible, in the centre of the square a large *pucka well* should be made at the same time as the houses are erected. I believe half the diseases are caused, and two-thirds induced, by bad water, or by water which if suitable for the consumption of natives of the place or for Europeans who have been resident there for any time, is totally unfit for newly-arrived coolies.

I have been in the habit of drinking water from a joun along with all the people in the factory just as it was drawn and quite unfiltered, and I had no fault to find with it; but the Protector of Laborers told me that it was just the sort of

water that would induce dysentery among new coolies, and I fully agreed with him. Newly-arrived coolies are peculiarly susceptible to stomachic affections, and of course to the influence of malaria, and water that flows through forest land, although it may suit those well used to it is certainly unfit for coolies. Were I to return to Assam I would spare no expense that would be at all in reason to have a large *pucka* well made at every factory where such coolies might be stationed, and I believe that it would save its cost in a very short time and be of the greatest benefit afterwards.

Coolies' houses cannot be kept too well plastered, for the people seem to thrive best when their houses are as warm as ovens. Coolies should be well fed and always supplied with abundance of food from the godown, *whether they earn the cost of it or not*, for the first nine or twelve months; and the planter will find that here liberality is the truest and wisest policy. Every cooly, male or female, should be supplied with a good rain-hat or *jhappee* in due time, and the cost, if deducted, can be easily obtained afterwards.

When Shahabad people or people from the Upper Provinces generally, get low and weak, a little wheat-flour or *attah* will be esteemed as a boon by them, and a little feeding on attah at the right time will save many a life; for if they get very weak during the first year, the chances are all against recovery.

Dysentery is the most fatal disease, and it seems almost incurable, for when once it gets fairly hold of a cooly, he may almost be given up; and English medicines seem to have no power over it in most cases. The *enema* with warm water and laudanum will often do good if given at a very early stage, but the cooly has an invincible objection to its use; but I should recommend its application whether the man likes it or not, as the relief it gives is great, and when the gut is well washed out the danger of ulceration is diminished, and medicine can take some effect. *Pucka* wells, I

firmly believe will be found the best safe-guards against dysentery.

The growth of such shrubs as dholl and what is known in Assam as *hate-bekori*, should be encouraged round the lines, as they are valuable preventives of malaria. And once a week, on every Sunday morning, the coolies should be made to scrub themselves and all their clothes till cleanliness is gained. This rule I consider should be rigorously and regularly enforced.

The planter should be very constantly with new coolies, and should personally ascertain their wants and strictly see them supplied. He will by so doing gain the confidence of the people, and secure the estate against loss, and if this be done very steadily for the first year, the demands on his attention will be wonderfully less afterwards. The payment of all labourers should invariably be made by the Manager or Assistants, as the temptation to swindle is too strong to be resisted by Native jemadars and writers, and these, although many of them are good enough in their way, and some of them (those of experience) often invaluable servants, still it is best not to allow them to have much to do with the handling of money.

Fifty coolies are quite as many as a Sirdar can properly supervise in the field, but a good man can look after fully that number. The Sirdars should be made responsible for good order, &c., in the lines, and it is generally to their good offices that the employer must look for re-engagement of his hands. It is of course a great thing to secure acclimated people on the termination of their first agreement. It will pay to give them a Rupee per month increase of wages, and a liberal bonus of ten Rupees say, besides, for they are in every way preferable to new coolies even if at a greater proportionate cost. In re-engagement transactions if the old Sirdars be unpopular and have no followers, it is best to let them go and appoint others from the coolies them-

selves, their promotion, of course, being conditional on others remaining with them.

Advances in the strict sense of the word should never be given to coolies, * as they are not to be considered worthy as a rule of credit; and unless in exceptional cases, the utmost concession should be payments on account, such as money, clothes or provisions given during a month on account of work actually being performed, and the cost of which should be deducted when the wages of that month are paid.

The coolie's probable laziness, his liability to sudden death in any little illness, and the chances of his absconding are all arguments against allowing him to have advances; and, moreover, when a man gets into debt he is seldom good for much, and tendency to abscond is greatly increased.

Pruning.

The object of this very important operation is of course the production of the maximum quantity of leaf by training the plant to the best possible form for yielding, and by increasing its size; and it is also a remedy for evils occasioned by neglect, want of cultivation, or carelessness. The subject of pruning is one on which opinions have been indeed divided, and much difference still prevails, although the close observation and infinite experiments of latter years must have reduced controversy to very narrow limits. On a subject like this controversy can surely only continue from ignorance, for there can scarcely be two right ways of doing so necessary a branch of work. Yet I am mistaken if the two camps are not as strong here and there as ever. I refer to the "high" pruners, and the low pruners, partizans who would loudly proclaim and confidently defend their different theories, and as vigorously and unhesitatingly carry these into practice.

The adherents of the low-pruning principle certainly went to work the most recklessly, and would often leave a garden

* *Vide* Remarks on Accounts.

looking like a mass of sticks of firewood, and this I have known to be done for some years consecutively. Certainly those who erred the other way, left room for remedy, which the low pruners by a rule did not, but in too many cases "killed the goose that laid the golden eggs." Unless as a *desperate remedy* my experience has invariably shewn me that low pruning is a grievous mistake, and I look on the practice (by no means out of vogue) of continued "cutting-down" plants is a most erroneous and suicidal policy: the plant is over stimulated in the first place: it never attains to its possible greatest bulk or breadth in the second, and, unless saved, will, on bad soil, die out, and on good soil diminish to a dwarfed stunted shrub as a final result. It is only indeed in superior soil that the plant can sustain such barbarous treatment, two or three consecutive heavy prunings on poor soil will soon end its career as a leaf-producer, and will make it do its worst in this capacity on land of the richest description. I consider that those thorough going low pruners who believe that they cannot too soon commence with the adaptation of the principle to the plant, and therefore begin by systematically nipping the seedlings of the first year are quite as much in error, although there is not the fear as yet of fatal consequences. This plan is to tip or nip the seedling of one foot high to *make a bush of it from the first!* And accordingly a bush *is* made of it, and the plant by the shooting forth of numerous little branches is at the end of eighteen months about half the height it would have naturally attained, and about the size and shape of a large cauliflower, and with its *stem* and *branches* of an equal thickness. In the third year this unnatural seedling having become a "bush" is plucked, and at the end of this third year, cut down unsparingly and heavily, its appearance after the operation being as if one had untied a small bundle of firewood and stuck the bits in the ground about an inch apart from each other, seedling and bush at the above mentioned stage looking

something like this (Figs. 2, 3, and 4.) In fact those who periodically prune on this principle subject the plant to what they believe to be an ordinary and necessary operation, but this operation, I am convinced, should never be performed but as a *desperate remedy*, and I will afterwards shew in *what* cases I believe it *is* necessary. Let us consider before proceeding into practical details what in the first place the natural growth of the plant is, and then bearing in mind, carefully, the artificial requirements, let us see in what manner, if at all, this natural growth may be most correctly modified to meet these requirements. The tea plant if allowed to grow to the full bent of its natural tendency will attain the dimensions of a small tree, and will be too large for the definitions of shrub or bush to be correctly applied to it. I have seen such trees myself which could not have been under 20 to 25 feet in height and of great breadth in proportion, and I doubt not but that others may have met with larger specimens. Now the object of cultivating tea plants is to get leaves from them, which leaves it is evident could never be gathered from plants at their full natural growth. Granted this, then you must limit this natural growth, and this again being self-apparent, we come to the great question "*where* shall we fix the limits?" Look at it as it stands in its green glossy foliage—a magnificent shrub at the very least. What do we want from it? Leaf. How is this to be plucked, gathered, what you will? By the hands of laborers. What, with ladders? No, by laborers walking on their feet on mother earth. Then see to it that you let this tree, as you must dwarf and diminish it, be not dwarfed or diminished in the artificial state to which you are about to reduce it, by one inch lower than is compatible with possibility of plucking, and as you must deny its growing high, do all you can, for its sake and your own, to compensate for the loss by granting it breadth and aiding it to grow broad, that its natural heritage of *bulk* may somehow be preserved to it. This we believe would be the natural answer, as we believe it

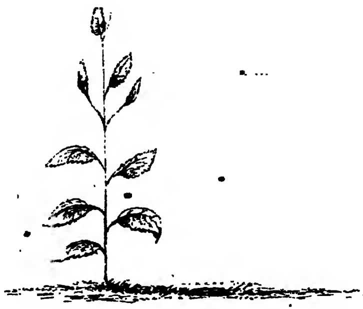


Fig. 2.
ædling of 9 months, nipped at dotted line, (about one foot high.)

Fig. 3.
General appearance of a tipped seedling of 18 months, (about 18 inches high.)

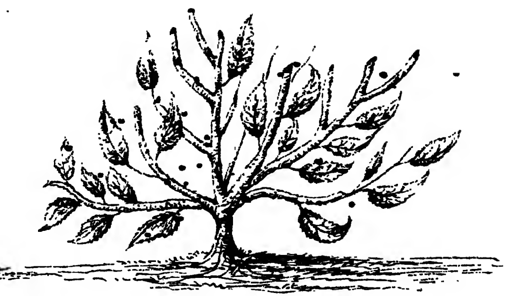


Fig. 4.
A heavily pruned bush as frequently seen at the end of the third year.

is the rational one and the truest conclusion that can be arrived at. It is difficult, after full consideration of the whole question, to conceive on what grounds a seedling that of itself would naturally grow into a noble bush is thwarted and checked from almost the moment it appears above ground, or to credit that a man who deliberately cuts a young bush down till it looks like a number of upright sticks of firewood a few inches long has ever set eyes on a full grown tea tree. Then according to this theory we should allow trees to fully develope themselves, and then cut them down to the maximum height at which they can be plucked? Certainly not, that could never be done practically, nor do I argue for it, although I would observe by the way that supposing you had to prune down trees that had attained their greatest natural size under favorable circumstances a better method could not be adopted. The exigencies of practical planting, whereby money has to be sunk to a large amount for at least two years without any chance of a return, demand that the return shall be obtained as soon after that period as possible, and as a rule the plant is called upon in the course of its third year, although very little at best can then be got from it. But the principle I have set forth should be carried out as far as all the circumstances will permit. From the time that the seedling appears above ground it should (receiving all the while the most careful cultivation) be allowed to develope itself after its own fashion until the last moment up to the application of the pruning-knife, which should be at a point that, making allowance for the springing of new shoots, will give the maximum of height at which it may be conveniently plucked. This is presuming that the seedling is a healthy and clean grown one, as after careful treatment by good cultivation it naturally would be. That this course is the best I am firmly convinced by repeated observation and by long experience. For instance, a seedling fit for pruning, that is of two years old, should with good treatment in suitable soil attain a height, if unchecked, vary-

ing from four feet to six feet. The latter height would be as a rule unusual, although I have known instances of plants under favorable conditions growing to the height of five feet in eighteen months, and in Assam, on good soil with steady cultivation, a height of about five feet would not be very extraordinary. The appearance of the seedling being as shewn in Fig. 5. Such a seedling I would prune at three feet, an inch more or less, with regard to any peculiarity of the plant, mattering little.

A plant thus trained has to begin with a stout strong stem, and the pruning adopted leaves it ample room for side development, and it is only at the sides that real development is possible.

Very little surface is at the first obtained for plucking from, perhaps, indeed, only the top of the main stem, but this is no drawback, for very little should be expected from a plant in its third year. The side branches of the seedling should be *absolutely left untouched* by the pruning knife, and the strictest care should be taken that, during the season, not a leaf is plucked from them. They will all have an upward tendency for the most part, and anything that shoots above the plucking level which will be about 3 feet 6 inches may be taken, but only that. At the end of the third year the plant will be something as shown in Fig. 6. If at this stage the plant be pruned two or three inches below the point of the last pruning say at 2 feet 9, or 2 feet 10 inches, the chief of these upward tending side branches will be caught and at a sufficient thickness to give good shoots. These side branches so pruned will thenceforth cease to be side branches but will form part of the upper plucking surface. Perhaps 2 feet 9 inches would be the more desirable height at this period, for in the succeeding season the shoots after this pruning should spring vigorously, and the pruning will have to be made on *them*, or rather on the new wood formed by them, and not any more on the old or what we may term the original wood of the plant, and it may

Fig. 5.

seedling of two years' growth. Pruned at the line (about 3 feet high to dotted line.)

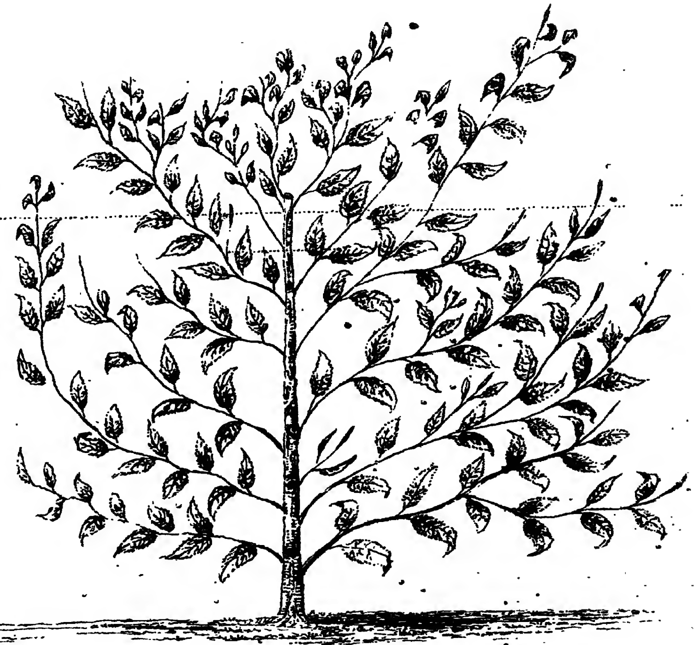


Fig. 6.

Plant at end of third year. The dotted line indicates where the pruning at this stage should be made, about 2 feet 10 inches. The main stem being taken a little lower.

be found advantageous then to leave four inches of new wood to the former, which at the end of the fourth year would bring the tree up to its first standard of three feet, or perhaps an inch above that, Fig. 7.

Subsequent prunings should be made much in the same fashion, care always being taken to keep the plant to a practicable plucking height. What are called crows'-feet will form in spite of the utmost care, and these should be always cut out. I maintain that a tree so treated if properly trained from a seedling will not require to be cut down for many years, and it would then be from the formation of crows'-feet lower down and in the centre of the bush. Very old trees are often the better for being cut down very low, as low indeed as in Fig. 3, but this is often a risky experiment and manure should always in such cases be liberally applied. I have given in the foregoing observations the theory of the high pruning system, which I believe to be the true method of pruning. It is necessary to remark that I have been thinking throughout of plants of the Assam and hybrid varieties. The China variety of plant differs in many respects from these, one of its most unfavorable characteristics being the tendency to "run to seed," another, to form what is known as "whip," *i. e.*, their branches of the size and somewhat of the look of whip cord, both of which tendencies being against the production of leaf, and which will be seen in full force wherever the plant has been allowed to run up, or to follow its natural inclination of growth. As compared with the other two varieties it may be termed an ungenerous plant, yielding leaf sluggishly, and the leaf being very apt to harden. For all of these reasons it requires the knife much more unsparingly. The "whip" must always be cut out right from the bottom. As a rule, however, the remarks as to the pruning of the Assam and hybrid kinds are quite applicable here, but an allowance of six inches or thereabouts lower should be made in dealing with the China, and there will generally be more to do in the way

of cutting out "whip," "knots," and "crows'-feet." "Is the practice of low pruning then altogether unworthy of consideration? By no means—it has its special uses; and it would be absurd to say that good plants are not to be seen under its general application. But we should always endeavour to know what is best and then do that, and from what I have tried to shew, it will be seen that the tea plant requires height, and therefore the best plan is to go straight to work from the first to obtain this desideratum, with which as a matter of course, breadth, and therefore bulk, will be got likewise.

"One principal use of low pruning is to remedy the evils it has itself in a measure laid the way often for; thus if a plant has been cut down very low, and if the shoots have not been allowed to develope fully, but have been too soon plucked, the tree may be, nay *will* be, full of thick crows'-feet and knots at the height of very probably two feet from the ground; and before anything can be done with such bushes it will be indispensable to cut out these, no matter how low they may be, otherwise clean, straight shoot-producing branches, will never be known in a bush like this, and consequently a good yield will never be obtained from it, Fig. 8.

"As an instance in point I know a garden which last year was in this state. The trees had been cut down in the cold weather of 1868, and the shoots plucked when they had risen three or four inches from the old stumps, which stumps were not more than 15 inches from the ground. The consequences were as described, and although the bushes were dwarfed, ill-used looking things, it would have been folly to have allowed them to remain as they were, and the knife had to be put into them at a height of about an inch above the old stumps. After *this* pruning, however, the shoots were not touched till they had developed into branches. To give one or two further illustrations of my remarks:—at the end of 1866 I had a fine field of young plants, two years old, and fit for pruning. Some had been tipped and were low and bushy, but for the most

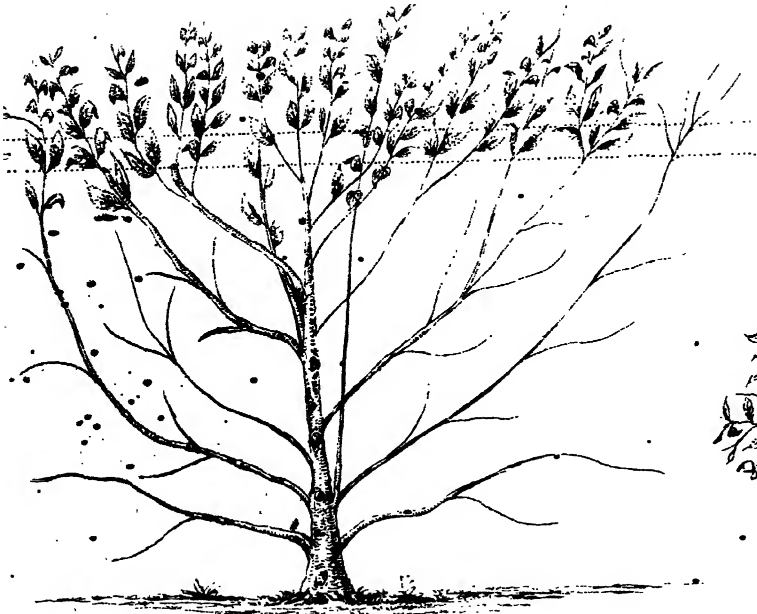


Fig. 7.

Tree at the end of fourth year. The lower dotted line shews where the pruning of last year was made. The upper where it should now be effected about 2 feet 11 inches to top of second dotted line.

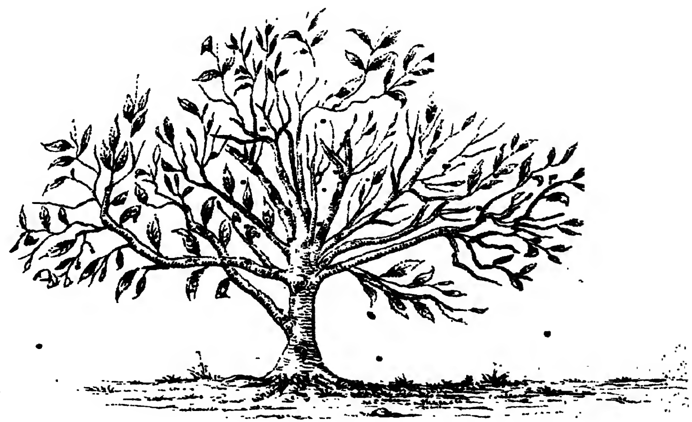


Fig. 8.

The sort of bush that does require cutting down. The causes of the necessity being low pruning and premature plucking.

part they had grown up freely. I cut half the field on the low pruning style, heading the centre stem well down to about two feet, and leaving the sides six inches higher in a saucer sort of form, the other half I cut at three feet straight across. I found I could begin to pluck much earlier from the latter, as great care had to be taken to let the hearts of the low pruned bushes be filled up by the new shoots. On the whole, however, I got more leaf from the low pruned trees that season, but there was no comparison as to the increase in size and appearance, in which the high pruned bushes beat them hollow. When they were pruned the second time, the high bushes had far the greater surface, and yielded more during the following season, while their rapidly outstretching side branches gave promise of the whole field being well covered at no distant date. This latter symptom was where the low pruned bushes shewed to great disadvantage. In the cold season of 1865, I knew a garden that was cut low down for no ostensible reason beyond that it was the right thing to do. The soil was not particularly good, and manure was never once thought of. The plants for the next three years seemed as if they never would recover themselves, and for the year immediately succeeding, the yield was miserable. I have seen old bushes in poor soil cut down, and known that for the whole of the following manufacturing season scarcely ever *give a shoot.* Some people are impressed with the idea that the best shoots are to be got from the thickest branches, but I think that observation will fully demonstrate that the lustiest shoots come sometimes certainly from the very foot of the tree, out of the ground as one may say, but oftenest from the clean straight branches of the thickness of the little finger, and I believe that to seek for increase of leaf by the cutting of the oldest branches (the prime reason of low pruning) is utterly incorrect, and those who support the theory from "their own experience" are planters who have been blessed with the

advantage of superior soil, whose power they have never been able to utilise to the utmost, and to which power alone it is owing that their delusion has but been rapidly made manifest. Good plant in good soil with good culture will live vigorously and shoot luxuriantly for many a day, no matter how you maim and maul it, but this only makes the reflection in such cases the sadder, when one compares the *what is* with the *what might have been*. Never cut down tea plants, I say, except in cases where the course is dictated by absolute necessity, and then always apply manure liberally. And, another golden rule, never touch the side branches. Long straggling branches if on the ground may be curtailed, but in several you will lose more than you will gain by trimming the sides even of straggling branches. When a man gets a knife in his hand the temptation to hack and hew is very strong, and the knowledge when to stop very vague; and as I have said before, side branches have a natural tendency to come up, and thus to contribute to the breadth of the top-plucking surface. As to the best time to prune I would say the nearer Christmas day the better. Early pruning, in November for instance, I have found to be a mistake. In large gardens where much ground was to be got over, the work often is not finished till the beginning of February, but this is too late. Where old trees have to be cut down autumn is not a bad season, and I have frequently known the most satisfactory results to be obtained. When such plants were cut in August, a *slanting* cut should always be made, and shears should never be used, as they jag the branches and bruise them. Rodgers's pruning knives are in great favor with some, and the quality of them is invariably good, but they will be found too small for quick work, as the light upper twigs cannot be taken off rapidly enough unless with a knife of larger size. A knife somewhat like a shearing hook, but much smaller, is very generally used, but I always find it faulty in one respect, *i. e.*, it is extremely difficult to get

Fig. 9.

Fig. 10

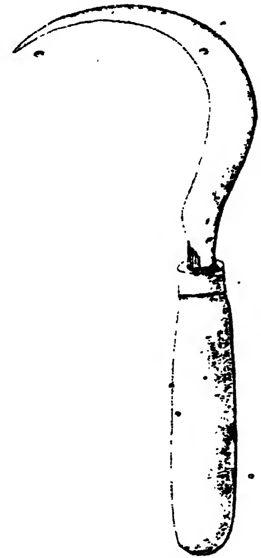


Fig. 11.

Fig. 9.—Rodgers's latest knife

Fig. 10.—The pruning knife recommended (length of handle about 8 inches from bottom of blade to curve about $3\frac{3}{4}$ inches, from curve to point, about 2 inches.)

Fig. 11.—The sickle-shaped pruning knife.

a quick true hold on a thick branch with it, as it is so apt to slip round, and a man has to go "fiddling" with it for a few seconds, and even then the knife will often slip, and he will finish the cut with a different part of the blade to that which first entered the wood. I found this so serious a defect (although the knife was very good for dressing the light branches) that after a little experimentalizing, I made a knife which I found suit capitally for both heavy wood and for twigs, &c., in top dressing. The blade came straight from the handle for about four inches and then bent out almost at a right angle for about three inches, or less, this part being very slightly curved. When a thick branch has to be cut with this knife the top or bent part of the blade is put against it at the corner formed by the straight part, and, giving the extreme point a little upward tendency to the right, the knife is drawn up towards the body, and as it is sharp and of rather heavy make, it will come cleanly through the branch without slipping at all. The straight part of the blade will be found to cut off twigs, &c., better than the little knife of Rodgers's, or than the sickle-shaped ones, Figs. 9, 10, 11.* These knives can be made quickly and cheaply by any native blacksmith.

* Since I wrote the above I have had another opportunity of proving to my own satisfaction that this is the best pruning knife I know of. I pruned this year with it, with a few of the sickle-shaped knives and with some of Rodgers's knives. I find again that the sickle-shaped knife is the worst of all, slipping greatly at thick stems, and being too much bent to admit of sufficiently free play in taking off the upper twigs. Rodgers's last knife is a very good one, but the knife I made is quite as good for cutting through a thick branch, and much better for cutting off the twigs, as its length both of handle and blade gives far more force.

The men who were supplied with sickle-shaped knives all applied to have the other kind, and I found too that while last year's Rodgers's knives are quite blunt and require a great deal of sharpening, besides being jagged, the others are as good as ever, or with very little trouble become quite sharp, although this must be put down to better metal. Any how, it is a fact.

The *cost* of pruning, with wages at Rs. 5, and with the bushes of ordinary good size, should not be more than from Rs. 2-8 to Rs. 2-12 per acre. Where heavy pruning is needed, and the bushes are of good size, it will cost more; but pruning is work that it would be extremely unwise to set any fixed nirrikh for.

Plucking.

This is as important a branch of work as any in tea planting. On it both the yield of leaf, (and therefore the outturn of tea) and the condition and health of the bush very greatly depend, to a greater degree than those not well acquainted with the cultivation of tea would probably believe. Bad plucking will most undoubtedly tend to impair the vitality of the plant, and will diminish its yield, while careful plucking conducted on sound principles will have the precisely opposite effects. The tea bush will commence to shoot, or as it is technically termed "flush," in the beginning of March, and sometimes in the end of February in Assam and Cachar, and in the Dehra Dhoon in April, while in Chittagong the time of flushing is, I believe, at an intermediate period. A good deal depends, in commencement, as to how the bushes have been pruned. If they have been cut down very low then the utmost care and circumspection will be needed in dealing with the new shoots, for these must be looked on as the *nuclei* of the future tree; for the bush as left by the pruner, it will be obvious, is hardly worthy of being called a *tree* and was to *grow* to one, and if, therefore, care be not taken with the coming shoots, there will be no tree at all, and the pruned bush will just remain what it is. With bushes that have required little pruning, and are of good average size with no lack of young wood, the same degree of cautiousness is scarcely needed; or neglect, at least, will not produce disastrous effect, as in the other case. In the latter instance the main consideration should be to get proper

shoots developed that these may harden into leaf giving young wood, in the former the chief thing to be seen in the first place, is to get *branches* for the tree.

Assuming that a bush has been from necessity pruned down to 18 inches in the close weather, *leaf* in the spring month should be no consideration whatever, nor should ever be plucked till a good growth of young wood has been fully secured. No shoot should be touched if less than eight inches long. Many will soon acquire that length, and these may be carefully tipped, and two or three of the top leaves may be taken. The slowest growers will be found generally in the centre of the bush, and great attention should be paid to see that these are never touched until they have drawn level with those at the edge of the surface of the bush. If they are nipped when small, the chances are greatly against the bush becoming a clean straight growing leaf-giver, and the planter by negligence will lay up more pruning difficulties for himself in the future.

I consider that at such times the planter, casting aside for the time all other work as much as may be possible, should remain incessantly with his pluckers, for mistakes at this time will not be easily remedied, and will at least arrest the progress of the plant. Later on careless plucking may spoil *shoots*, but it will not much effect the tree itself.

If the bushes have been high pruned and the shoots are springing from vigorous young wood, there is no real necessity for allowing them to grow higher than four or five inches on commencing, but this length should always be allowed, for independently of good shoots being required for the production of leaf, *it is to these shoots that, as a rule, even in high pruned bushes, we must look for the new wood of next season*, and unless some special reason render it necessary to prune low, the pruning of the following close season will have to be done on these coming shoots, and with bushes it is almost as necessary to make sure of the new wood as with

the low pruned one, only in this case three or four inches of good clear stem will suffice.

Fig. 12.

Plucking it will be thus seen, although its peculiar use is the obtaining of leaf, plays a most important part in the formation of the plant.

The shoot having attained the required length should be plucked, or more properly speaking, *tipped,* at first by having the first two leaves and a portion of the third taken off, thus Fig. 12, although, indeed, it will be safer to tip at first by taking merely the bad and fresh leaf. Fig. 13. The dotted line shews the place of plucking.

Fig. 13.

At the second plucking when the more backward shoots will have grown as high or probably higher than those tipped at first, and when the latter shall have thrown out others, there need be no hesitation in taking the bud and the fresh two leaves, and from a good shoot even a portion of the third leaf as in Fig. 14.

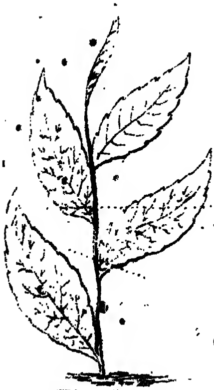


Fig. 14.

But this third leaf should not be taken at the second plucking with bushes that have been low pruned, and require to grow, the harm indeed not

being in the taking of the leaf itself, but in the license even to the pluckers to take more than the first two leaves and bud, or "*teen patti*," for the chances are that they will go far more reckless to work if told that they may take the four (including the bud) than if they are restricted to three. But with high pruned bushes, four leaves can be taken without fear after the first plucking is over. It should be remembered that the obtaining of the new wood depends very greatly on the *first plucking* of the *shoots*, as after that "crows-feet" form, Fig. 15, and no good wood that can be relied on to shoot well will, as a rule, be got above these. It is always best to make sure of at least as much new wood as may be required ere touching the shoot at all.

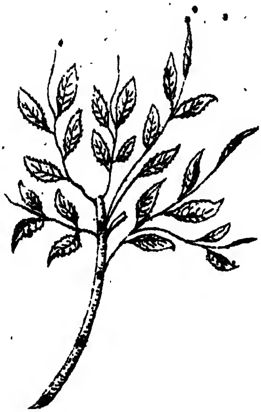


Fig. 15.

Fig. 16.

In plucking it is always better to have an eye thus, Fig. 16, as this ensures careful plucking and proper treatment of the shoots, and moreover very much assists the growth of the new shoot that will spring from it, as the coming bud will be sheltered thereby, and will receive moisture more surely, and if the lower leaves of the shoot be

Fig. 17.

plucked in this manner the shoot will multiply itself, and much more leaf will be got than by the ordinary way of plucking which is generally as shewn in Fig. 17.

This will be seen by a reference to the sketches at foot, Fig. 18 representing the shoot plucked as recommended and Fig. 19, the same shoot with the new ones springing.

But in actual practice while it is always best in plucking to leave the bud so protected, and to encourage the growth of others,

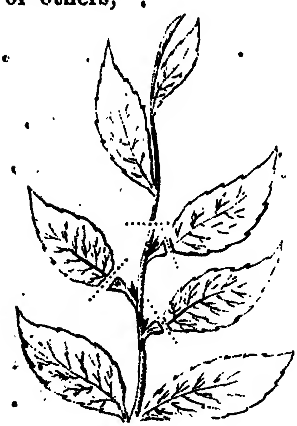


Fig. 18.

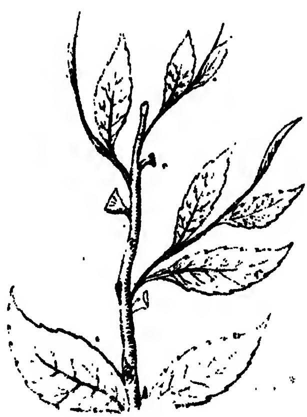


Fig. 19.

it will generally be found impossible to adhere strictly to this principle, which will, when a heavy flush is on, be found far too tedious a way to be practicable, or if it be insisted on, the leaf is almost sure to get old from the great length of time taken to pluck in this way. Nor, will it be found possible in such

a case, with probably a very large field of pluckers, to ensure any strict adherence to the plan.

I consider that if the method be enforced and its performance ensured by incessant supervision during the first flushes every useful end will be served, and after the young wood is made sure of and the shoots are flushing vigorously, the main consideration should be, as it will be in practice, to get the leaf "off" in time.

I saw a pamphlet lately in which the great advantages of this mode of plucking were shewn, and it was contended that by it the yield could be enormously increased, the rate of progression being somewhat like that of the problem of the nails in the horse's shoes. It was said that by this manner of plucking a new shoot was secured where it would otherwise never have been obtained, that, it again would throw out others, which in their turn being similarly treated would produce more, and so on, till the yield of a bush at the rate asserted would soon have been something fabulous. But in practice this will not be found to be anything like the case, indeed it is obvious that if it were, the "tea difficulty" would be overcome in a single season, and thereafter every planter would become a Monte Christo.

Indeed after the first offset the value of the plan is *not* in the production of an increased growth of shoots, (for these will be found to spring *just as vigorously* in the middle of the season, from the ordinary plucking,) but in the actual protection of the shoot itself, and the great thing when the bush is in full vigour and flushing fast is to get the leaf off.

This plan I have seen termed Mr. McMeekin's, but I have known it practised in Assam for the last nine years, and I have myself, for the last seven years, or since I first supervised plucking, always gone on the same principle. Whether the method indicated by me *be* Mr. McMeekin's or not, I do not know, perhaps his is different, but the plan I have detailed has been known and followed in Assam for years past. As to

the alleged great multiplication of shoots I can say that I have often tested the experiment in its entirety and found that the shoots produced after a few pluckings in this progressive style became very thin and needle-like, while the best shoots were always thrown out from places up or down the branch, where, by this theory, they would not have been looked for. Fig. 20. (The shoots referred to being marked dark).

Fig. 20.

I have seen at many gardens this mode altogether disregarded, and indeed prohibited, and the yield could scarcely have been better, nevertheless I should give the preference to it, and certainly think it necessary at first.

When I was in Assam I saw a very novel way of ensuring the growth of the young shoots very successfully practised by a gentleman who was one of my assistants, and who had to do all his plucking at the time with a set of indifferent and somewhat refractory imported coolies. He left the Pekoe bud on every shoot for the first three times of plucking, and the result was so satisfactory that he ever afterwards adopted the plan in the first spring plucking. The work required great care, but the result was certain, and if the shoots were found on inspection *minus* the top-bud, the cooly was "cut" his *haziri*. The first two leaves alone were taken, or on a very good shoot the first three, the shoot itself being quite uninjured and going on increasing, while new ones were rapidly thrown out from where the leaves had been taken, so that

even the Pekoe bud did not always push forward and develope the shoot, but on the contrary opened and even became hard ere the leaf could be taken off; there was no danger of the shoot remaining stationary, as it would always shoot at the other points. Fig. 21.

Fig. 21.

I think that if ordinary care be exercised in the preliminary tipping there need be no necessity for this lengthy and rather troublesome operation, but it would be found a good plan in a similar case where there existed any doubt as to the carefulness of the pluckers.

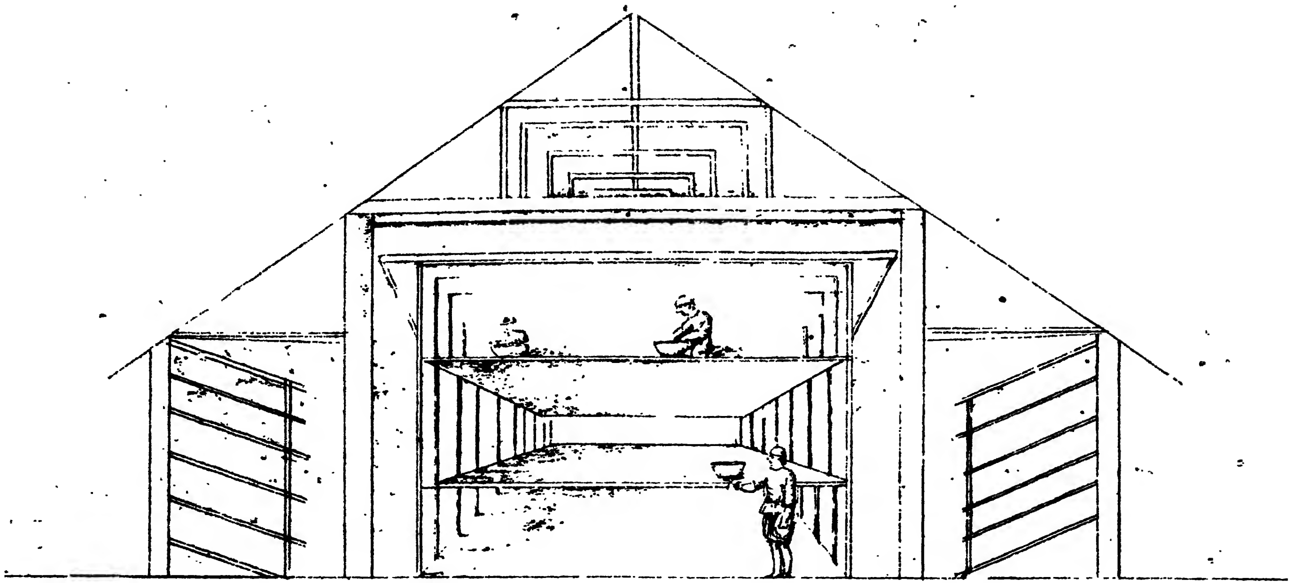
As to the cost of plucking, the regular established nirrikh is 7 seers for women and children; (who are as a rule only employed), at which rate it costs rather less than a rupee per maund if green leaf, but for plucking by contract a pice per pound is generally paid which makes the cost per maund Rupees 1-4. The planter had better not employ any contractors until the shoots have attained the growth necessarily to secure the young wood required, nor should he even put his own coolies on any nirrikh until then. The plucking baskets should always be made very wide in proportion to their breadth, and I think that a flat shallow shape would be an improvement on the deep basket now in use, as the leaf would be less liable to heat, although they would be awkward where the bushes were very thick; but at all events I think the baskets might be made, without going to extremes, much wider proportionately than they now are.

Where separate plucking for sorts is done different gangs are employed, the Souchong leaf pluckers following those taking off the Pekoe bud and leaf, and so on. The mode of plucking is the same as the ordinary style, a small leaf being, properly, left. Of course this latter style of plucking is much more expensive than when all the leaves of the various sorts are taken at one time.

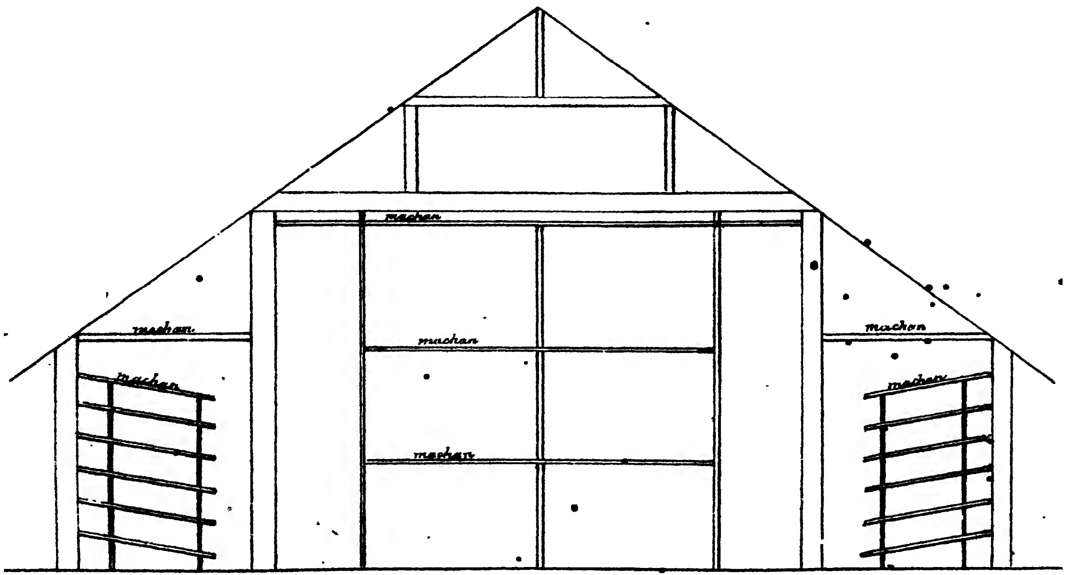
Manufacture.

In commencing my remarks under this heading I do not wish to discourse upon the properties known as theine, tannin, &c., appertaining to tea, as I think this is not the place wherein to do so, and indeed I know little or nothing about the attributes assigned to the article by science.

It is undoubtedly desirable that the planter should possess as much knowledge as can be acquired about that which it is his avocation to produce, but any scientific knowledge is not likely to help him greatly in producing it, for he has very little free choice in the matter, nor, if he be wise, will he desire it. Tea being a marketable article has to be made to suit the tastes of the buyers, and the interpreters of those wants are, at present, the tea brokers. The dictum of his broker must, as a rule, be followed by the grower with, I may say, a blind obedience, for, generally, it is impossible to divine reasons, or assign the causes for their requisitions. The chief point is to know how to meet the broker's wishes, and as those are very variable, the method of manufacture follows a rather deviating course. With regard to black tea generally, the leading characteristic requisites are, however, pretty well fixed, and univerally known to all connected with tea planting. These are, *first*, a *strong flavored liquor* or, as it is termed in trade parlance, *water*, and a deep red, clear colour to the same, as these requisites secured, the tea is sure to be, in the main, good. The manner of making black tea is this:—The leaf, when brought in from the gar-



Perspective view of Leaf Shed.



Section of Leaf Shed shewing the arrangement of machans, scale 1 inch=8 feet.

N. B.—The side machans are for leaf trays.

den is spread out overnight, very thinly, in withering sheds: when flaccid it is rolled, and after panning, it is dried off over charcoal fires.

To take these processes in detail, we must commence first with that of *withering*. This is best accomplished on round bamboo trays or *challonees*. I think leaf withers on them much more rapidly than when spread on the matted floor of the shed or strewn in machans. But the great want usually in the manufacturing busy time is space to spread the leaf on, and any place at all suitable is used for the purpose. Matted machans and floors is a cheaper arrangement than dependence on trays entirely, though the more of the latter there are the better. Leaf that can be withered without sunning, will produce *stronger* flavored tea: these will be got from leaf withered in the sun, and it can seldom be withered well and effectually in the former manner unless on trays, and these admit the action of air so thoroughly to the leaf, and their construction is such as to forbid any thick spreading. It is seldom, however, that sun-withering can be quite dispensed with, and the sunning intervals between showers are usually eagerly taken advantage of. But it is always best to endeavour to have the withering done in the shade, if possible, and to put the leaf in the sun only when very rainy nights prevent the other plan. Leaf that is not thoroughly fit for rolling can be immediately detected by breakage when under the hand, and generally by grasping it gently. In very continuous rainy weather, when the sun may not be visible for days, and the atmosphere is heavy with moisture, withering is almost impossible, and there are two choices open either to work up the unwithered leaf or to dry it artificially. An extreme degree of breakage is sure to attend the first method, but the tea will, though broken, be of as good intrinsic quality as that made from well-withered leaf, which will not be the case with tea made in the latter way. Charcoal is generally used for the purpose and it has the effect of discolour-

ing the leaf and, consequently, the tea, this being disagreeably perceptible in the commoner sorts, while the flat open leaf instead of being red as in the ordinary way, turns out yellow and is almost worthless in consequence. The flavour, moreover. is in no way so good; but as the finer varieties are not affected so greatly, and as the loss in broken tea is excessive when the leaf is worked up unwithered, the general practice is to wither over the charcoal, although I think that this should only be done when there is a large quantity of wet leaf coming in during a period of continuous rainy weather, and then to as little an extent as possible. A very good plan that I have tried is to have a *machan* over the charcoal fires above the dhools, say ten or twelve feet high from the floor, and well supported. It should extend from one side of the tea-house to the other, and will be found very handy for aiding the withering leaf in rainy weather, as the steady upward heat effects this. This method is open to the charge of danger through fire, and I cannot gainsay it. The danger would be in a dhool accidentally catching fire and blazing up, in which case the machan would be sure to go too, but I consider that there is no danger whatever from the charcoal choolas as they are too far below it, and they are generally kept very carefully. A machine invented by Mr. Dickenson professes to wither leaf as well as dry tea, and I should think from what I have seen of it, that it would do so pretty well. The leaf is placed in trays in drawers and hot air is driven through them by a fan which is worked by a gin and bullock or by hand. Whether this machine be good for the desiccation of tea or not, I cannot say, and it does not seem to have come into any general use, but I should think it would be well worthy of a trial for *withering leaf*. It burns very little wood, costs little, and does not take up great space.

In rolling the leaf 20 seers is the assumed nirrikh, but it is rather an excessive one, and it is better, unless the leaf be very fine and well withered, to allow five men to every two

maunds. A rough mat should be avoided, as it will break and cut the leaf greatly, and if the mat is of bamboo, it cannot well be too fine or smooth. In Upper Assam reed mats, known as *seetal patties*, are used sometimes, and they are very suitable. I believe that canvas is employed at some gardens in Cachar, and I should think it would answer very well, but I have never seen it tried myself. In rolling, the pressure should not be great, nor should it be *downwards* on the leaf, as many tea rollers appear to have the theory, judging from their practice. It should be sent *forwards* from the operator in as continuous a roll as can be given, the hands being used alternately, one to roll, the other steady to guide the leaf, the pushing hand when at arm's length being turned to the extreme front of the mass of leaf to draw it back again, when the other hand pushes, and so on alternately. After this first rolling of the leaf it is generally squeezed into balls, which are of a size a little larger than can be grasped by both hands together. Some do not do this, but I think it certainly tends to fix the twist of the leaf and for that reason should be followed. These balls are set on trays in two layers and allowed to remain till of a sort of salmon colour, or of a light reddish brown, when the leaf should be carefully disentangled, and any knots separated, and the leaf is then fit for panning.

This latter operation is discontinued at many factories, and the leaf after being untwisted is carefully rolled again, and dried over the charcoal fires, generally right off at one firing when this plan is adopted. But I consider that as a rule one panning is desirable. The old plan was to give two. The *first* in a pan at a brisk heat, and the *second* at a lower degree. A gentleman belonging to the firm of Messrs. Moran and Co., the Brokers, having, however, visited Assam, and noted the various processes, recommended that panning should be dispensed with as being unnecessary, and his advice when I left Assam was being very widely followed. But I

believe there is very little to choose between panned tea and unpanned, and I think that the better plan is to give a panning in a moderate degree of heat and to do it rather slowly. The leaf should never be allowed to ferment too long, a weak liquor is the result of its lying too long after the first rolling, while the sooner it is panned or fired off, after becoming red, *the brisker will the flavor of the tea be.*

Panning stoves are made at most places of clayey earth, which after being worked up with water is allowed to stiffen and then is cut to the desired shape, but I would suggest as an improvement to those still following this plan, the use of *kutcha* bricks, and the building of the stoves of *kutcha-pucka.* Abundance of good clayey earth is generally to be found somewhere at most factories, and any earth that will do for the formation of stoves in the old way will serve for very good kutcha bricks. No lime is necessary, but simply the same sort of earth made to the consistency of mortar with water and plastered between the sun-dried bricks. The edges of the fire-place and the key of the arch of the stove should be of pucka brick, at least it will be better to have it so.

After panning, or after the second rolling in the unpanning method, the leaf is dried off immediately in both cases as far as practicable; but the leaf that cannot be quickly done off should be spread out very thinly, as it is apt to sour in this stage. Bright fires should never be used in the choolas, but they should always have a slight sprinkling of ashes and the dhools or drums should be frequently removed. It is generally impracticable to thoroughly dry off the tea at one firing, and accordingly it is usually left over night half-dried. It is better, I consider, to leave it rather soft in this stage than crisp, and it should not be spread out thicker than two inches. In the morning the process is finished by the final drying of the tea.

Great care should be taken that the panned tea is not left too long before it is put over the choolas, as it will certainly

go sour, in fact at no stage is it so apt to become sour tea, and over-fermentation in the green or unpanned state is not so harmful as excessive delay after panning.

This is the usual mode of making black tea, and it will be found the best. The planter should satisfy himself by the look of the tea in the leaf as to its outward appearance, and, he will be able to judge whether it has been properly manipulated; and it would be well if he were day by day to test its quality of liquor by having a little of it infused in the pots and cups used by the brokers. These are of white China and may be obtained best through the good offices of a broker. They are not easily got in Calcutta. The time for infusion is five minutes, and a weight equal to that of a six-penny piece is employed. If the tea turns out of a deep rich red colour, a ruby sort of hue in fact, and if the infused leaves are of a bright light brown, it may be safely concluded that the tea, as at present required, is of good quality. Should the infused leaves be mixed with black ones it is a sign that the tea has been burnt, and on these evidences the planter, without knowing anything of "pungent" flavors, "malty burnts," "full but ra-flat," or such like technicalities of the palates of the trade, may form very sound conclusions as to the quality of his produce. And I consider that every planter should make it part of his day's business to taste his tea once at least. A small sample could be regularly prepared for him by his tea-house sirdar, and having the weights, cups, &c., together with a kettle always kept on the tea-house, the whole operation would be accomplished easily in ten minutes while there would be the satisfaction of knowing with much accuracy what was being made; and when we consider the fact that sometimes very superior looking teas for leaf, "water" very badly, and the look of the leaf is not by any means a proper test of the quality of the tea, this testing should be looked on as an imperative duty to be done as much as a matter of course as the rounds of the garden and tea-house are made.

There are other ways of manufacturing black tea than that detailed, but widely different methods are seldom followed, and other processes are usually merely variations of the one general plan.

The following is a Cachar system, and it produces very fine silvery Pekoe ends, but it has the disadvantage of requiring a good deal of tedious manual labour more than should be really required in black tea manufacture.

1st.—The leaf must be clapped with the hands. One man does two seers, for 15 to 20 minutes, and when the leaf is ready it will be found to be very sticky.

2nd.—Heap it up for fermentation on a dhalla or tray covered with a wet cloth: about 10 seers should be so placed on one tray, and the cloth should not be well wrung beforehand, in fact not wet, but *damp*.

3rd.—Ferment the leaf for one-and-half hours, turning it over occasionally.

4th.—Roll the leaf and roast on a slow pan.

5th.—Expose in the sun or, if it should be rainy weather, spread the rolled leaf out in the tea-house—if in the *sun*, for 15 minutes, if in the tea-house, for about an hour. The tea must not be allowed to get too dry during the process, or it will break in the second roasting.

6th.—If possible, now, place the tea in the shade for three quarters of an hour.

N. B.—In the foregoing process, numbered as 5, the tea must be turned over twice or thrice.

7th.—Roast again and roll.

8th.—If possible, again expose the tea in the sun, and dry afterwards over the charcoal fires, if not, then dessicate in the ordinary manner.

This plan as will be seen involves a good deal of care and the labour is greater than in the usual way. I do not think, on the whole, that there is anything extraordinary in the quality of the tea manufactured thus to compensate for the

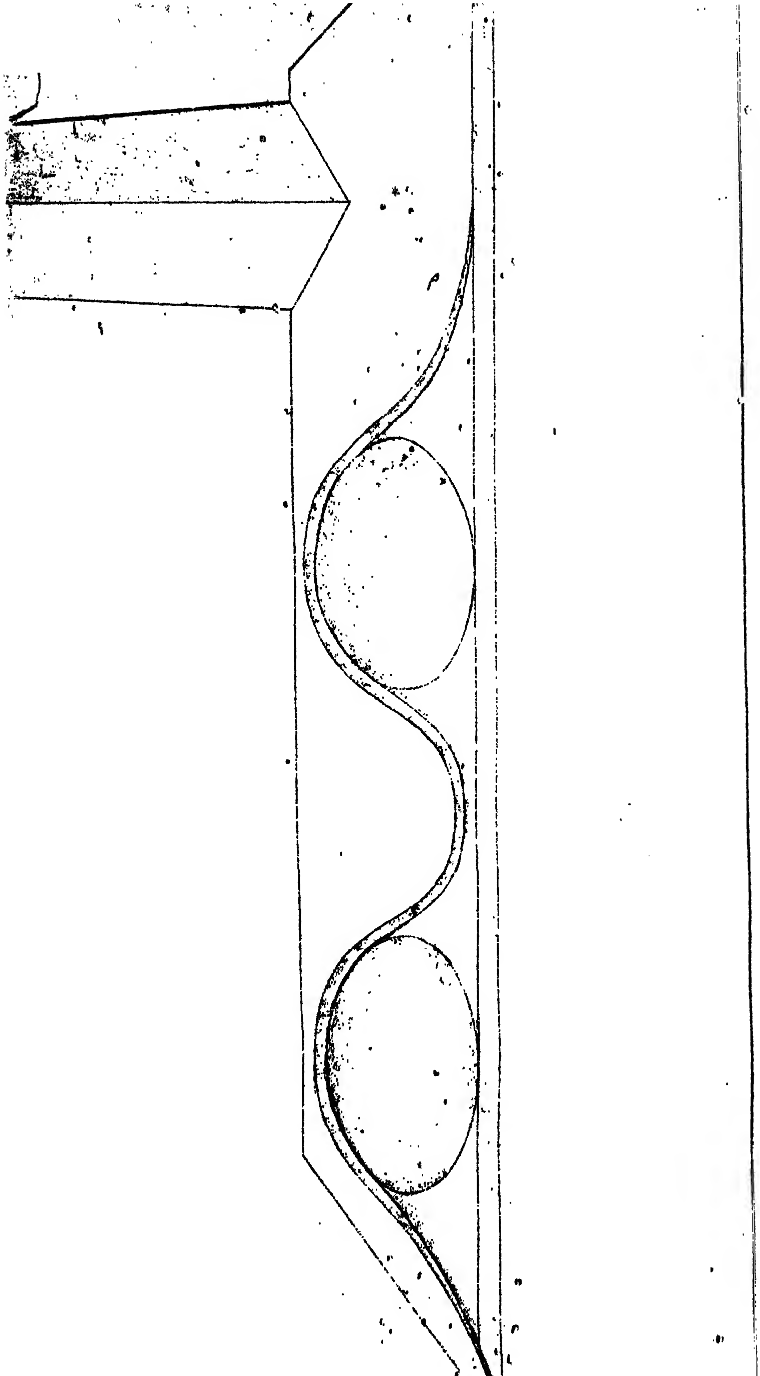
extra trouble; and there is very much more danger of matters going wrong. However a very fine flavored tea is the result if the process be rightly carried through, and the Pekoe tips are very silvery.

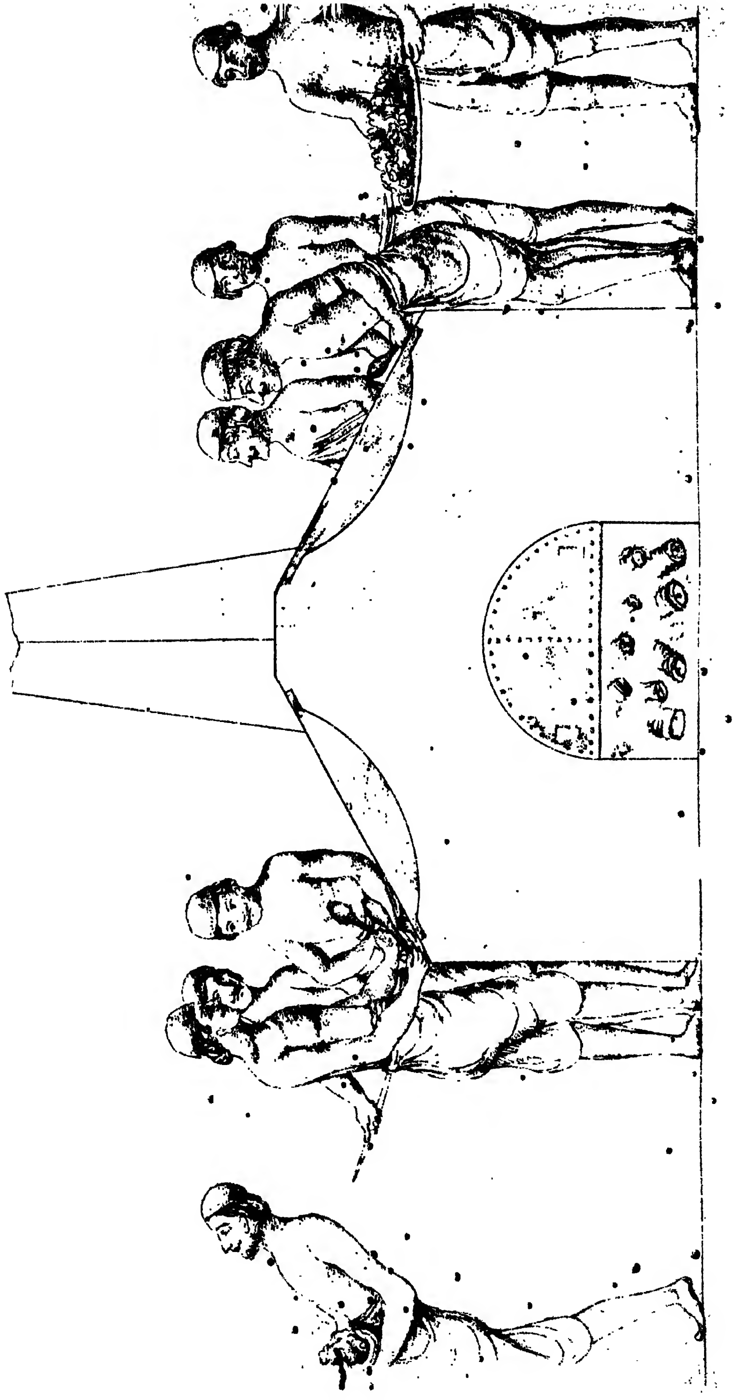
For those who prefer *golden Pekoe* ends (which the trade however do no class so high as the other) the best thing is to use pretty brisk charcoal fires, and ferment a little more than is usual.

Oolong is made in the following way:—

The leaf when brought in is placed, as for green tea, about a foot thick over night, and next morning is bound up tightly between bamboo mats until well heated. When unbound, the heat of the leaf should be great, so much so as to render it impossible to retain the hand among it long if thrust in, and it should be red colored, in a state of incipient fermentation, and it is then roasted in a brisk pan and well rolled. After this it is exposed in the sun until it dries to a degree that renders it blackish in hue and sticky to the touch. It is then worked in the pan as follows:—the pan is that used for facing green tea, being shallower and more perpendicularly set than the black tea roasting pan. Fully a maund of leaf is placed in each pan, and the mass is pushed upwards and over by the tea-makers for about an hour and-a-half. This labour is very trying, and two men are often needed. The weight of the leaf is considerable, and so, gradually, is its heat. After coming from the pan it is desiccated as ordinary black tea over charcoal, and becomes quite black as regards the finer leaf, the coarser leaves being of a yellowish colour. The flavor is very much like that of Indian green tea. As will be seen from the foregoing description the labour is greater than in black tea making, and now-a-days this description is never made save for private drinking, as it is disliked and condemned by the Calcutta brokers, and I believe by those in London too, although a very good and true Oolong tea can be made in the above way.

To make green tea the leaf should be worked as soon as possible after being plucked. In practice some hours must elapse, necessarily, and leaf gathered in the afternoon *must* lie over till the following morning; but there can be no doubt that the fresher the leaf the brisker and more pungent will the flavor of the tea be, the difference between tea made from leaf immediately after plucking and that which has lain over for a night being very perceptible, and greatly in favor of the former. The fresh green-leaf being brought in, is, without any withering or any preparation, thrown into a hot pan (much hotter than that used for black tea) and briskly stirred about for a couple of minutes or thereabouts, during which time it emits a great deal of steam and crackles noisely. It is then rolled quickly on the tables, and being perfectly flaccid, the leaf takes on a capital twist in a rolling of two or three minutes. Afterwards the tea is exposed to the sun until it becomes sticky and dark coloured, and then is worked off in the facing pans like Oolong, and, generally, immediately after this, it is filled into long narrow bags and compressed till the maund of tea inside is almost, to outside handling, as solid as wood. This is done by twisting the end of the bag by a stick, screw fashion. The tea is thus left all night, and when taken out next morning, all the larger leaf will be found to be very round and well twisted. The tea is, at this stage of a brownish-black color, with the open leaves of a dark yellow, as those of Oolong. To produce the green color, no pigments or coloring matter of any kind are used. This is brought out in the facing pans, into each of which ten (10) pounds of tea are placed, and worked rapidly from right to left in the pans which is at a moderate bent, by a tea-maker. An hour, or an hour and-a-half's work at this will change the tea from a blackish, half-open roundish leaf, to a dull grey, closely twisted leaf, the better done leaves being something like shot in form. This process being again repeated prior to packing, the tea becomes a bright grayish





color with a very closely twisted leaf, and it is then as it comes from the pan boxed off.

Bamboo sieves are used for the separation of the various qualities, which according to precedence of class are Young Hyson, Hyson, No. 1 Gunpowder, No. 2 Gunpowder, Imperial, and lastly the dusts. The reason for using sieves of bamboo is the brittleness of the tea and its tendency to go to dust as compared with black.

It will be seen that the process of green tea making is much more laborious than that of black, and it has the disadvantage of losing greatly as compared with the latter.

As a rule the proportion of tea to leaf is one-fourth as in black tea, but the loss by first and second coloring is seldom or never less than nine per cent. By some "bagging" is being discontinued, that is the tea is made without the bags being used, but the loss is on the green leaf, much the same in the end. Young Hyson and Hyson should be longish in the leaf and curly. For Gunpowders, the rounder and more shot-like the better. The test of liquor is that it should be of a *pale bright yellow*, with the infused leaves of a *bright pea-green color*—granted these, and the tea is sure to be good.

The facing pans I would observe are usually built on the plan of four to a stove, two on each side, and the fire-place at the end, thus, Figs. 22, 23, and I would recommend a trial of this plan to Assam planters for their black-tea roasting-pans, as where several of these have to be used on large gardens I feel sure they could effect a considerable saving of fire-wood, certainly, as regards the plan of one pan to one stove 50 per cent.; and if a plate of sheet iron be fixed across the mouth of the fire-place, say for one-third of the distance from the top of it, it will be found that the stove will draw better, and burn less wood. The stove should as a rule be made of *kutcha* bricks—these answer for the purpose, even better than *pucka* bricks, and are much more easily worked

with than a mass of clay.

The bare cost of manufacture is easily calculated. It is generally taken at the rate of a man for every 20 seers of green leaf, but as I said in commencing this subject, that is a full nirrikh and cannot be strictly worked to in practice, as the out-turn of tea from the quantity of leaf rolled to make it is just about one-fourth, the produce of 20 seers of leaf would be 5 seers of tea, or ten pounds for one man's work, which is at the proportion of eight men to the maund of tea; but if we take nine men we shall be much nearer the mark, and neither err much on the side of extravagance nor of undue exaction.

Assuming that a tea maker's wages are six rupees per mensem, then the wages of nine men for a day would be say 1-12-9, which is what tea, so far as the bare manufacture goes, can be produced at, and working at the strict nirrikh, the amount per maund would be Rs. 1-9-7 or very nearly four pies per pound (at the former rate a little over that).

In assigning the nirrikh for green tea manufacture, the same rate is usually given as for black, but nine men to the maund of manufactured, is the number that in practice will be generally needed, and the cost of the two succeeding facings will amount to certainly one pie per pound more, or fully five pies per pound. But as regards black tea, manufacture is being done by the machinery now coming into use at a cost not exceeding one-fourth of the above figure; the machine invented and patented by Mr. Kinmond producing tea ready for final firing at 6 annas per maund, or less than one pie per pound, witness this testification from the Assam Company's Superintendents.

Nazeerah, 11*th May*, 1868.

To J. Kinmond, Esq.

Sir,—We the undersigned have pleasure in testifying that your leaf-rolling machine is, in our opinion, a success.

That it is capable, when driven by a small 3½ H. P. Engine, of rolling 40 maunds of green leaf in a day's work of from 8½ to 9 hours.

That it gives a better twist to the tea, with smaller proportion of broken leaf, than can practically be obtained by hand-rolling, when leaf in any quantity has to be worked off.

That the cost of rolling 40 maunds of green leaf daily for a month of thirty days is as follows:—

	Rs.	As.	P.
Engine Driver (say)	25	0	0
Six coolies, at Rupees 6	36	0	0
Twenty seers oil, at Rupees 13 ...	6	8	0
300 maunds fire-wood, at Annas 2 ...	37	8	0
Five seers grease for Engine, at Rs. 10	1	4	0
Five seers jute, at Annas 2	0	10	0
Six yards canvas, at Rupee 1	6	0	0
Proportion of labour for repairs ...	1	4	0
	Rs. 114	2	0

That is about 6 annas per maund of tea ready for final firing, as compared with the cost of the same work by hand-rolling, *viz.*, Rupee 1-9-7 per maund, or wages of eighty men at Rupees 6 per month, Rupees 480.

(Sd.) John Phillips.
„ P. H. B. Severin.
„ A. B. Fisher.
„ Walter H. Bennett.

This machine of Mr. Kinmond's has been in use for three manufacturing seasons, and is being very generally adopted in Assam, Cachar, and Darjeeling. I believe that about 200 pair of plates have been at work in 1870, and it is undoubtedly proving itself a real saver of labour, and that in a

great degree.

The *modus operandi* is that the leaf is rolled between two large metal plates, the effect of the motion being nearly identical to that of hand-rolling, while the machine can be worked either by steam power or by bullock or pony. There is also a smaller size which can be worked by hand by two men, and this is capable of rolling a maund of leaf a day. A machine with two pair of plates will roll twenty maunds of leaf a day, while one with four plates will do double that quantity. The weight of the machine is, for every pair of plates, about 8 maunds, and the erection of it is a very simple matter. The size of a 4 pair plated machine is about 16 feet long, 5 feet broad, and 4 feet 6 inches high, and half that size for one with two pair of plates.

There can be no doubt as to the really important degree to which the machine saves manual labour. The patenter puts the saving at four-fifths, and it certainly does save three-fourths assuredly, and at the reduced rates it will soon save its own cost. The two pair plates machine is estimated to save the labour of thirty men daily—now, their wages at Rupees 5 per mensem, amount to Rupees 150 per mensem, which for the season is Rupess 1,200, and the reduced price of the machine is Rupees 80, so that would shew it in a most favourable light, were its great utility and economy not already so generally admitted.

A hand engine I consider a perfect boon for a small garden, or for a garden in its first years of manufacturing. The cost of this is, complete, Rupees 45. As already mentioned, with two men it can roll seven maunds of leaf per diem.

In practice it is generally found best to give the leaf a finishing by the hand, and it must be made up into balls, &c., by the same means, but very little perfecting of the twist is needed, four men per table being sufficient for both requirements, and for picking out flat open leaves, &c. This would necessitate the work of 18 men for a large machine,

men for each pair of plates and 2 to attend to the needed, besides the Engineer, in all 19 men, which is at a higher scale than quoted in the testimonial of the Assam Co.'s managers, as they only allow for seven men. With these 19 men however as much *thoroughly good work, i. e.,* as much leaf rolled as perfectly as if entirely done by hand, can be done as by 80 men rolling by hand, and this fact should need no further comment.

It must not be forgotten that the machine does nothing toward the desiccation of the leaf, that must be done by tea makers as before (unless a Dickenson's machine be used) and if, therefore 20 seers of leaf per man be taken as the standard nirrikh of work from withering up to the final desiccation, the amount of saving must be considered as less. Thus a large size machine with 18 or 19 men will, according to the foregoing statement, accomplish as much as 80 men will, but if these eighty men are supposed to finish the process of manufacture, they will do more than the machine will, for to complete the task at least from 10 to a dozen more men will be needed after the machine has performed its part. But even then the saving would be very great, 31 men doing the work of 80; but there are no real grounds for making this depreciation, as 80 men would never do the work in so good a manner, and as I have said before 9 men per maund of manufactured tea is the number that in practice it is found as a rule necessary to allow, and sometimes more when circumstances are unfavourable, and the merits of the machine rest as before.

I have seen the engine of the machine ingeniously adapted by a friend of a mechanical turn, to a small saw-mill in the cold weather, and very good work it made. The frame-work of the machine, levers, spindles, cranks, &c., are all of malleable iron, so there is little fear of breakage, and no piece is heavier than can be carried by four men. The prices are as follows:—

	£.
A machine with 2 pair of plates to roll 20 mds. leaf per day	80
Ditto „ 3 pair „ „ 30 ditto ...	120
Ditto „ 4 ditto „ „ 40 ditto ...	160
Hand machine complete	45
3 H. P. Engine adapted for wood fuel	80
2 H. P. ditto	63
Bullock or poney gearing	18

Duplicate.

	Rs.	As.	P.
Mitre wheels, per pair	6	0	0
Cranks, per set of three	15	0	0
Main shaft plummer blocks	4	8	0
Double bearings for large cranks ...	4	0	0
Ditto ditto small cranks ...	3	8	0
Cup for the bottom ends of the crank ...	1	8	0

There is a machine by Mr. Dickenson, but its pretensions are very humble, and it is not supposed to do more than render the leaf fitted for hand-rolling. It consists of a large box which works on rollers and is filled with heavy stones, and this operating on the leaf, which I think is first put into gunny bags, is said to lessen the after labour considerably, but I have never seen it used anywhere.

There is, I believe, a rolling *table*, the invention of Mr. Meekin of Cachar. It costs only Rs. 150, and it is said that it can be made by country carpenters, but I have not seen it working and cannot therefore say anything about it.

For the desiccation of tea, several attempts have been made at various periods to supersede the use of charcoal, but none has been attended with any real success. If charcoal could be dispensed with, I fancy every one who has anything to do with the enterprise would rejoice, for it is expensive to make, and wood is yearly becoming scarcer. Whether the use of charcoal is indispensable or not is a point that seems never to have been decided. I have, like many others I dare say, heard remarks to the effect that the Home trade asserted charcoal

but what the foundation for the assertions were I have never been able to ascertain, nor how charcoal peculiarly affected the leaf. But I have never yet seen tea dried otherwise so good as that done by charcoal, and some musters that I tasted last season, (which were prepared very carefully by a neighbour of great experience) made in pans only, were certainly in no way comparable with ordinary tea. The leaf was not so good in appearance, and the liquor was relatively very much worse than the leaf, and although not at all burnt, had a most peculiar flavour such as would probably be classed by the trade "flat and odd." The substitute for charcoal so far as I am aware remains yet to be discovered, and the present consideration is how to burn it cheaply and most effectually. I imagine I am not wrong in supposing that those in charge of gardens will agree with me that charcoal making is one of the most unsatisfactory branches of the work pertaining to a factory, if not *the* most unsatisfactory beyond comparison.

It is generally now-a-days carried on necessarily at remote parts of an estate, often far in the forest, and is not therefore under any steady supervision, and although the nirrikh can of course be ascertained by weighing the charcoal as it is brought in, and paying the men accordingly, it will be often found that, if the coolies wages have to be regulated at the rate of 4 annas, say, per maund, very often they will get far below their usual wages, much of course to their discontent; and in such cases, unless direct negligence can be proved, it is difficult to "cut" their pay with feelings of satisfaction, for undoubtedly they have to deal with many difficulties in their work as one any who has made charcoal under varying conditions will allow, and they are probably isolated from their lines for the whole week which naturally makes them more aggrieved at scrimp remuneration. Even when a gang is working well by results the waste of wood is sometimes deplorable, and yet one hardly knows how to check it. I have known plan

ters make the most wonderful declarations as to what they could get done in the way of charcoal-making—*they* only paid an anna a maund or something like that; but I had always believed that there was some entire misconception, and generally planters will be found to admit that their charcoal costs "far more than it ought to" and that they cannot practically mend matters. By far the best way is to get it burnt by contract, but that is not easily done now-a-days. I think some more assured method will soon have to be found out as wood becomes even more difficult to obtain. In Europe charcoal is burnt so carefully, especially at the gunpowder manufactories, that not a grain is lost, but all goes to the designed end without waste, and the way in which it is made in iron cylinders at the Government Factories is wonderfully careful and exact, although very costly and unsuited for a tea factory. The present "kutcha" plan could surely be improved on somehow. We have little need of charcoal in this district, as it does not enter into the processes of green tea manufacture, save at rare occasions, but should we take to black tea manufacture as the principal part of our business, I shall certainly endeavour by experiment to avoid the waste of wood, and to work with greater certainty of result,—that accomplished, the question of economy is settled, for it is the failure to burn properly all the wood that is cut which causes the waste of material and the profitless employment of the men. How would it do to have fixed places for charcoal burning and cart the wood to them instead of working in the ordinary wandering fashion? Where hackeries can penetrate the forests to the charcoal pits they could as easily bring wood, from the forests to fixed spots, say close to the tea-house, and the difference between the cost of cartage of wood and that of charcoal would be more then made up, I believe, by the constant efficient supervision. Might not the pits be made of pucka brick with steps leading down to them at each end, and at each end of the trench which would be under the pit

for air might there not be a grating of iron which could be closed at the proper time by an iron door?

Only such wood as would be piled above the pit would then have to be plastered over with earth, &c., and the trench under the brick-floor would be kept free for the primary circulation of air, and could be properly closed at the exact period. It is the continual falling in of earth and the choking of the apertures that results in the frequent imperfect charring of the logs; and again if these be left too long open, as they often are in the present system, the contents of the originally huge maund of piled logs will too often be found to have collapsed to the dimensions of a few baskets of small coal.

How would it do to burn the logs in a brick chamber like a huge oven, having a suitable trench running the entire length at the bottom, with a door large enough to admit a man and to let large pieces of wood be put inside? The wood might be carefully piled inside, and as it would gradually rise above any side door, the roof of the oven might be bisected by an opening running its entire length, of about a foot or eighteen inches broad. This would allow of the upper part of the chamber being filled with small wood after the larger pieces had reached so high as to render work inside impossible; while it would also let the smoke and fire have free vent at first, and it could be closed afterwards, either by earth and clods being thrown on, or by a thick iron door of its own size which could be let fall when necessary. Small gratings could be made at the sides with doors. They would be useful in case of a difficulty in burning at first and could be closed as needed.* This may be a quite impracticable plan, and I

* The dimensions might be, say, length 12 feet, breadth 8 feet, height 7 feet. An iron door to be at one end nearly as high as the kiln or oven itself. The top to be open to the breadth of 18 inches for the entire length. This would necessitate the erection of, say, four brick pillars inside to support the roof. This opening to have an iron door of its own length to be shut when necessary. Gratings or orifices might be made in the sides for the better circulation of air, and a trench should run under the kiln (provided with doors if thought necessary after earth would close them effectually) for the same purpose.

give it just as the idea has struck me. The experiment might be worth trying, and the thing might be shaped to something practical, while as to expense, there will soon be scarcity enough in some parts to justify the outlay of a little money in brick and iron.

As the work is now done, burning in pits is seldom practised, but the logs are piled up from the ground on a level place with a narrow trench underneath, and when this is finished the whole is covered with branches, leaves, &c. and then covered over with clods and earth, which are sometimes plastered with mud and water. An opening is left at each end which is closed when it is thought that the fire has got thoroughly alight, and the clods at first are thrown on rather lightly, as a rule, to ensure the whole lighting well. I have found that as good, if not a better, plan is to have all the men present and logs ready, and after laying the foundations, to light the under-tender and then quickly pile up the logs. In this way the certainty of the fire is established, and it gets fair hold throughout and after enough wood is on, the *whole* can be safely covered up with earth without leaving any aperture at all. I have often made charcoal in this way with very satisfactory results; but the men must be nimble and sharp or the fire will bother them; and a good sirdar should supervise, for if they are lazy the fire will gain, or come up so strongly as to prevent their finishing, but this will never be the case if they work ordinarily well.

In Assam, bamboo "dhools" (Fig. 24) are generally used in preference to the ordinary brick choolas, although the new charcoal economising choolas are fast superseding both: these are great savers of charcoal, but require much careful attention. The arrangement is precisely on the same

Fig. 24.

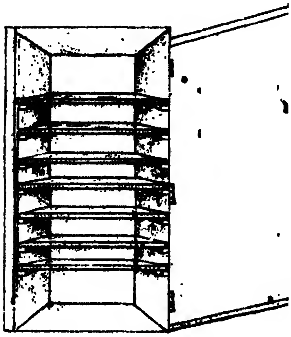


Fig. 25.

principle as is a chest-of-drawers—the drawers in this case being the trays holding the tea to be dried, Fig. 25. The sides of the choola should be of *pucka* brick, and the door should on the inside be lined with tin. The lowest tray should be at the ordinary height from the fire and the upper ones at just sufficient distances apart to admit of their easy removal. The positions of the trays vary with the progress of the desiccation.

When the tea is ready for firing off over the charcoal, it should be worked off as rapidly as possible, as it is more likely to turn *sour* at this stage than at any other time in the process. Delay in firing off is in my opinion much more the cause of sourness than any over-fermentation previous to panning. In proof of this take any tea that after panning, or, where panning is not done, after the second rolling, has been allowed to lie long beyond the usual time: it will be found to have a most disagreeable, noxious smell, which will never leave the leaf, either after desiccation, when it will be as strongly perceptible from the dry tea as from the undried leaf, and the same colour will pervade the infusion. The heat from the choolas should be gentle and equable, and should be tempered by ashes, &c., strewn over the fires as occasion needs. One tea-maker can look after 10 moorahs or dhools.

When the manufacture is on a large scale it is not possible to complete the desiccation at one firing, nor do I believe it desirable to do this. The tea should be half dried, and finished off the next morning. *It will always be better to leave it*

rather limp than crisp. It should feel when taken up just half dried in fact, and should have a sweet, pleasant smell. It should be now spread out on cloths to the depth of two inches, and finally dried off on the following morning, the operation commencing at break of day. I have heard hot newly-dried tea described as smelling like warm flat irons, and for good tea the description is by no means a bad one.

It should be always remembered that the danger of burning is apt to occur solely during the process of desiccation, and that the nicest care and attention are needed throughout it. Before placing the tea away in the tins, &c., it is the safest plan to infuse a sample, and the infused leaves will always shew whether any mischief has happened. If the tea is good the leaves will be of a bright coppery colour, "salmon colour" is the name given by the trade. The presence of black leaves, or of leaves with black ends, will be proof that some of the tea has been burnt. The liquor should be of a *clear* deep red.

A muddy liquor, or a liquor with two shades or rings of colour in it, never comes from a good tea, which on the contrary always gives a water of a uniform clearness.

Green Tea, as I have remarked before, should water a pale straw colour, with the infused leaves of a bright pale pea green. The practice that pretty generally prevails of bagging green tea in the course of manufacture is in my opinion a bad one. Better *Gunpowder* leaf, so far as make goes, is undoubtedly obtained in this way, as it fixes the twist better, rendering the Gunpowder round and "shotty" in appearance, but for this the penalty of a *red* liquor, and a coarse flavor must be paid. A comparison of the liquor of the two methods of bagging and making without bags will effectually prove this, the difference being surprising, and with the same quality of leaf the unbagged tea will give 2 annas more than the bagged for superiority of liquor.

Picking.

The tea must be freed of all red, open leaf by being hand

picked, which operation should be done for 2 pies per pound with tea of average quality; very coarse tea will cost sometimes double this figure, while on the other hand fine tea will admit of a large nirrikh being given and will cost less. The small particles of red leaf are allowed to remain in the tea until it has been divided by sifting when they are *fanned* off.

Sifting.

In sifting, the finest quality of tea is taken out first and the lowest last, thus the rough tea is first put into the Pekoe sieve, which is worked till all the Pekoe falls through it, that which remains on the top of the sieve is transferred to the Souchong sieve, and so on.

The sizes generally used are for *Orange Pekoe* No. 10 or No. 15, for *Pekoe* No. 8, for *Souchong* No. 6, and for *Congou* No. 4, the tea remaining above No. 4 being termed Bohea. The numbers are however by no means regularly adhered to, and the styles of classification are various: what some planters would class as Orange Pekoe others would call Pekoe, and Pekoe-Souchong at some factories, will be of the quality of a good Pekoe, and at others as low in stamp as a middling Souchong. It is best to adhere to the regular classification, however, as nothing is gained by over-classifying a tea, while the reputation of the grower is likely to suffer. On the other hand those who under class, and send up Souchong as Congous, &c., can only do so from an ambition to get high figures for classes; but the chances are that they will lose on the average.

Manufacturing.

The "Taxidianemeter" is a really useful machine, and I always prefer using it to sifting in the old way.

It separates most efficiently, and the sieves can be adjusted easily to produce teas of either a rough or fine character. The fanner blows out a good deal of the red leaf, &c., but not so efficiently as to obviate the necessity of fanning by hand

altogether; but the separating powers of the machine are first-rate, and that being so no complaints can be made of it. Its price in London f. o. b. is £17, and the patentee, is I believe a Mr. Jones of Fenchurch Street, although they are to be had from any of the firms in Calcutta who supply Tea Planters' requirements. Three boys can work the machine very well, and the saving as compared with sieving by hand is considerable, and sufficient to repay the cost of the machine, and leaves its possessor the gainer, in a very short time.

Green tea is generally separated by bamboo sieves, and they suit better as the tea is much brittler than black tea.

After being divided into sorts the tea is next fanned. This work is best done by women, the ordinary rice-fanners or "soops" being used. Care should be taken to see that no red leaf is left among the fanned tea, and that no tea flies out with the fannings; it is often well to do these over again.

Final drying.

Before being packed the tea must be thoroughly dry. There is no actual necessity for its being packed *hot*, but it usually is packed so. It is often as well to allow fine tea to cool ere compressing it in packing.

Good sound tea does not require more than eight hours firing. If there is any suspicion of dampness or mustiness that is quite another matter. Such tea should never be packed alone, but after being carefully fired should be mixed with a much greater quantity of sound tea.

Many planters fire their tea previous to packing for twenty-four hours, the object being to develope a peculiar aroma that it is asserted only comes after very long firing. As to this, any good tea after being over the charcoal for a few hours will give a very fine aroma, and twenty-four hours is an unnecessary long period. The chances are that the tea never *is* fired actually so long, as the amount of heat it receives during the

night when under the charge of two or three tea-makers is quite a matter of uncertainty. The main thing is that the tea be dry, and it may be dried very well and economically by exposure for a few hours to a strong sun on a dry hot day. Some planters assert that they prefer this mode to any. It certainly dries the tea very completely, but only sound tea should be so treated.

The usual way of final firing is to place the tea about four or five inches thick on a *dholla* or bamboo tray, which is put on the top of a "*moorah*," or "*dhool*" (fig.) placed over a carefully-tempered charcoal fire. On the top of the tea another *dholla* or tray is laid to cover it, and the drying commences. Some adopt another plan; *viz.*, they fill up the top of the "*moorah*" itself, a smull *dholla* being inserted in the *moorah* at the middle, thus, Fig. 26.

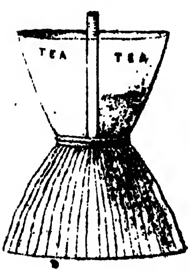


Fig. 26.

Sometimes a piece of hollow bamboo is inserted to carry off any smoke, but generally a *dholla* is used to cover the top of the *moorah*, as in the other way. I do not approve of this latter method, or at least very much prefer the former. In all cases the tea should now and again be turned over.

The tea when ready should be hot, crisp, and have a fragrant smell.

Other particulars of packing I have treated under the head of Box-making and Packing.

I would mention, ere concluding, that there is another tea rolling machine than those already noticed, and of later invention. I have never seen it and can only give the Patentee's statements.

The machine is called a "Patent Tea Leaf-rolling Machine" and is by Mr. James Nelson of Cachar.

It is stated to roll according to the different sizes, as follows:—

		Cost.
No. 1.—5 maunds green leaf per hour or 40 maunds in 8 hours	Rs.	600
No. 2.—10 maunds green leaf per hour or 80 maunds in 8 hours...	"	900
No. 3.—15 maunds green leaf per hour or 120 maunds in 8 hours	"	1,200
No. 4.—20 maunds green leaf per hour or 160 maunds in 8 hours	"	1,500
Machine Nos. 1 and 2 can be driven by 3 H. P. Engine, costing in Calcutta	"	800
Ditto Nos. 3 and 4 can be driven by 6 H.P. Engine, costing in Calcutta	"	3,000

It will be seen that the machine is evidently meant for operations on a very extensive scale.

I understand that the tea is rolled *in bags* between plates; that it can be made by any ordinary native carpenter; and that it was worked at Dooloo Tea Garden, Cachar, last year, and proved a decided success. A "single plate" machine is said to occupy 6 feet square.

The following memoranda are given by the patentee as shewing the saving by using the machine.

Cost of rolling 40 maunds leaf per day or 8,800 maunds in the season by hand.

	Rs.
8,800 maunds at 2¼ men per maund = 2,200 men, at 3 annas per day	4,125

Cost of rolling 8,800 *maunds of leaf per machine*—

	Rs.	
8,800 maunds at 2 men to 3 maunds leaf = 5,866 men, at 3 annas per day ...	1,100	
550 bags at 6 annas each or 1 anna 6 pies per maund of manufactured tea ...	206	
Engine driver for 8 months, at Rs. 15 per month	120	
Oil and Jute	50	
Fuel	300	
	1,776	

First year.

	Rs.		
Cost of Engine and Belting ...	900		
Ditto No. 1 Machine ...	600		
Royalty	350		
		1,750	
			3,526
Saving by machine ...			599

Second and subsequent years.

		Rs.
Cost of rolling by hand on 8,800 maunds leaf as above		4,125
	Rs.	
Cost of rolling by machine on 8,800 maunds leaf including labor, boys, &c., as above ...	1,776	
Royalty	100	
Wear and Tear	100	
		1,976
Saving by machine...		2,149

As I have said before I can only give these figures as I see them, and I have no knowledge of their correctness, never having seen the machine working. No. 1 machine can, it is said, be driven by bullocks.

From the above figures, however, it would appear that the machine works at a much greater cost than Mr. Kinmond's, as to roll 8,800 maunds of leaf which we may consider equivalent to 2,200 maunds of manufactured tea, costs Rs. 1,976, or even deducting "wear and tear" Rs. 1,876, which is at thirteen annas and seven pies per maund of manufactured tea; and although this is a saving, apparently, of a hundred per cent. of manual labour, it is double the cost of rolling by Kinmond's machine which rolls at between six and seven annas per maund of tea.

Box-making and Packing.

The planter will as a rule, always find it better to purchase his boxes than to make them at the factory provided he can get a good article. I believe that although by this plan he may apparently pay more, he will in reality save a good deal; and at all events he will know exactly what his boxes cost him, which, with a number of sawyers and carpenters to keep up as he will have if he makes his own, I believe he very frequently does not know. Anyhow, it has been the general custom throughout Assam for several years to purchase boxes in preference to making them, one great reason being the scarcity or inaccessibility of suitable timber, but another being that people think it better to pay a reasonable price for a sound well-made box than to undertake its manufacture themselves.

Assam is largely supplied with shooks from Burmah, and from the saw-mills about Khoostea, &c., while very good shooks are supplied (or were about eighteen months back) from the Dehing Saw-mills in Assam.

The main point is to have seasoned wood. Purchased boxes are usually faultless in this respect. Unless the wood

is well seasoned it will, of course, warp and shrink, leaving pretty free admission to the air through the joining and at the dovetailing. The thickness of the wood should be about ⅝ths of an inch, but if a hard wood, half an inch will suffice.

The usual dimensions of a *chest* (to hold 80lbs and upwards) are 24 by 22 by 18 inches, of a *half chest,* to hold 50 pounds 14 inches every way, and of a half chest to contain 40 lbs. 15 by 14 by 14 inches.* In the Dehra Dhoon we get very superior boxes of the half chest dimensions at a rupee each, or for the smallest size 14 annas and 6 pies. They are superior in make and finish to anything that I ever saw in Assam, and are supplied by ordinary village carpenters.

Care should be taken to see that the joints of the pieces of wood forming the sides do not coincide at the corners of the chest thus:

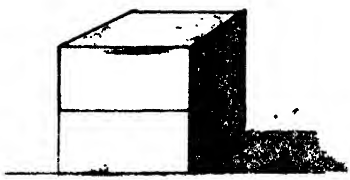


Fig. 27.

But in all cases they should join as shewn in fig. 28.

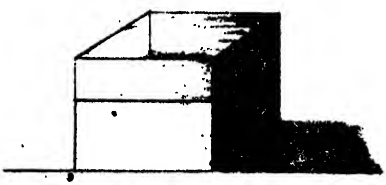


Fig. 28.

If made as shewn in fig. 27, the top of the box, if lifted by the upper part, is apt to come away altogether, but there will be no possibility of this if the joints be reversed as shewn in the next figure.

* Anything smaller than this is termed a "*box.*"

In ordering boxes it should always be stipulated that they should, if possible, be of one description of wood, and of uniform thickness of wood throughout so as to obtain equality of tare, but if there is any doubt as to these conditions being fulfilled, *the lids* should be taken of greatly varying thickness, as they will then be found very useful in working for this desideratum.

Boxes should always be kept till wanted in a cool dry place, and the carpenters should be set to work to equalise their weights. This they can do by having a pair of scales in the workshop and by taking a "namunna" box as a standard. By dint of judicious planning; changing of lids, &c., a surprising uniformity of tares can be attained without much trouble, provided that the work is commenced in good time before the packing requirements become urgent.*

I think that boxes are sent from Assam in far too rough a state. Were they planed and smoothed a little more, and somewhat better "got up" I feel sure that buyers would be better pleased, and planters would benefit by the slight extra trouble given. The boxes are next *leaded.* This is done by means of a wooden shape, which fits the tea-box almost exactly, and on which the sheet lead is soldered together. The shape sheet lead and all, is then placed inside the tea-box, and the shape being next gently withdrawn the lead lining remains.

A new plan is, however, to line the tea-box with as much sheet lead as may be necessary, and then solder it from the inside, and in this way it is asserted lead is saved, but I am scarcely of this opinion, while the work is much more difficult to perform and, I should imagine, the danger of burning the lead greater. The soldering iron should be of copper or should be faced with copper.

The leaded boxes should always be very carefully scruti-

* By adopting this plan this season, I had only one invoice out of fifteen, in which the tares were unequal—the others all agreed to a pound.

nised by the manager or assistant before being passed as fit for packing, as the native "*maistrees*" are apt to be careless, and if a manager has not hitherto followed the plan of examining the soldering he may have some disagreeable surprises on commencing it.

The tea should be *perfectly dry* when boxed, whether *hot* or not.

Green teas are always packed hot, just as they come from the pans from the final colouring. They are never pressed down, but a little is put in the box at a time, and then the box is well shaken, and in this way, "slack packing" (which is the trade term used when it is found that too little tea has been put in the lead and a vacant space is left inside) is avoided. Black teas are usually packed hot, although some to ensure against dust allow the tea to cool a little. Black tea generally has to be pressed down. This is usually done by its being trodden on by men. A cloth and a board should in this case be used. A packing press* has however been patented which should supersede this rather uncivilized mode. Tea may be effectually dried for packing being exposed to a strong sun for a few hours, but when this is done, there should be no taint nor supicion of dampness in it beforehand, and the day should be a dry, not a muggy nor streamy one. If the tea be throughly sound, a good deal of charcoal may be economised by taking advantage of hot dry days with strong sun to box.

The lids of the boxes should, in preference to being nailed, be screwed down, or a few screws should be used at least at the corners.

After being closed the next process is marking, which is done by stencil plates of tin or zinc, although sheet lead lies closer and gives a far better mark than either.

The factory mark or brand, the description of tea, the

* Jonas's patent.

break number and the chest number are all the marks necessary although the nett weight may be added.

As I have said before I think that boxes might well be got up a little more neatly than is usual, and I think too that a little more taste might be displayed in the marking. Other things being equal a purchaser will prefer a neat box, and I think a little more trouble might advantageously be taken in this respect.

The Dhoon boxes, both for neatness of make, smoothness of wood, and correct and tasteful lettering, excel anything I ever saw in Assam. This may not matter much with large chests of the commoner sorts, but chests containing the finer classes, and half chests of Pekoe and Orange Pekoe would be improved by the extra care in plaining to render them smoother, by the adoption say of a tasteful bordering or scroll to be stencilled round the sides, by correctly formed letters, which might be varied by being of the Old English character, &c., thus:

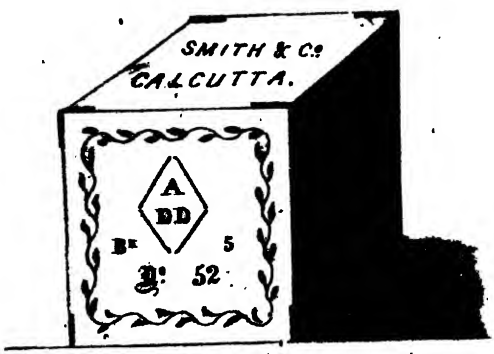


Fig. 29.

Fig. 29 which shows the pattern I have devised for my own boxes.

If the boxes are of strong seasoned wood it may not be necessary to add iron clamps, but if any doubt exist it is

better to use them, or to bind the ends all round with hoop-iron, which gives much strength and a very neat appearance.

Cane is often used but it is very apt to be ripped off and is not so good for protecting the package. With boxes of average strength clamps may be used at the corners only with much advantage thus :

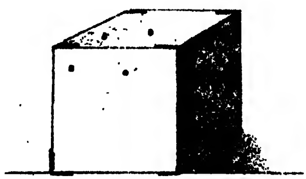


Fig. 30.

When hoop iron is used the ends should be fastened with a screw, as it too, is somewhat liable to be ripped off, though not so readily as cane. Care should be taken to use tacks instead of nails, or the lead will be penetrated.

In packing, the breaks should always be made as large as possible, and no trouble should be spared to attain a fair uniformity of tares, as other things being equal the tea of a large uniform break will always command a better price than that of small or irregular breaks. Of course as much care should be taken that the *contents* are as uniform as the boxes, and uniformity can only be got by bulking and in the case of green tea by sedulous comparison of color as the tea comes from the facing-pans.

In respect to machinery for box-making I think dove-tailing machines might be useful, but I do not think there is any need of box *making* machinery, as nearly every one purchases boxes in preference to making them in the factory, and I think they follow a wise plan, the more so in view of the scarceness of suitable timber.

Seed, plucking, drying, transport—best mode of preserving, and its utilization when not saleable.

Seed should be gathered in the end of October and beginning of November. When ripe the capsule becomes of a brownish color.

When brought in it should be spread out in a shady dampish place for a day or two, when the capsule will be easily removable by hand. The seed should be dried afterwards by being laid on the machans, but in no case should it ever be exposed to the influence of the sun, as this causes its fermentation and destruction.

When it is intended to use the seed at the factory where plucked the best way is to place it in beds of very carefully pulverised earth from which all roots, &c., have previously been removed, and spreading it in single layers to cover it with earth to a depth greater than that at which it would be sown out, say to a depth of three inches. The bed should be in a shady place. It this manner the seed will be effectually preserved, and it will indeed all germinate, but not too rapidly, and by the exercise of a little care, even the seeds lifted last may be taken up without any damage. If the sowing is made in good time most of the seeds will have only split and will be therefore only commencing to germinate, and such seeds are by far the best of all for sowing out.

Seed may be kept for a considerable time without injury by being laid in pits with alternate layers of charcoal dust, or charcoal dust and sand, although the former by itself is better.

The best mode of packing it for transport is to put it into perforated boxes—large tea chests, with broken or powdered charcoal, but for short distances it can be sent with perfect safety packed in gunny bags alone.

The soundness of seed can generally be pretty accurately guessed by its weight; light seed is invariably bad and useless, and so will be found a small proportion occasionally, of that

of good weight, which will be the case when any decomposition is commencing. A very good plan in sowing out with ungerminated seed is to drop it into water, when the good will sink and the worthless float, but this test is by no means an *infallible* one.

Tea seed *oil* is of a bright sherry colour, is almost tasteless, but has a strong though not disagreeable smell. It burns very well, but I do not think it would as a rule be very profitable to the planter were he to devote much time or labour to oil making. It would pay much better to sell the seed at any price within a reasonable limit, although of course in the case of a large crop without any offers the oil would doubtless repay the expense of gathering, and the cake might be advantageously used as manure; the latter being much the more really valuable of the two, in my opinion.

Management—best mode of, as respects labor, accounts, forms, adjustment of advances, &c.

There can be no doubt that European supervision is, rightly, not deemed necessary to such a degree as was common a few years ago, while the altered state of the enterprise has, naturally, rendered the condition and prospects of those engaged in it as servants less satisfactory and hopeful than of old. Managers and assistants have now far more to do, and are themselves under far more exigent supervision, than was the case a few years back, while retrenchment has given them less pay for it all, and the brilliant visions of partnership, "garden of one's own," &c., rise but seldom in their minds. Tea is felt to be like any other business, one that requires all one's attention, and all one's hard work to give satisfaction to employers, and to make it profitable to them.

The employment undoubtedly may be made, and indeed generally is, a satisfactory and remunerative one to those who know their business, and have made up their minds to work hard at it, but it cannot well be recommended as a good career

for a young man commencing life, as there are few avocations but would offer more attractions and rewards.

A competent planter can very well manage 250 acres in full bearing, and many have to look after more; but it would be necessary that these should be compact, or if not exactly in a ring fence, that they should not be much scattered. For more than 250 acres I think the services of an assistant requisite.

I know of some companies whose gardens are in sole charge of jemedars under a European general manager, the jemadars doing everything that used formerly to be done by European assistants, even to packing the tea and marking the boxes; but I think this, although it may answer in some instances with tried men, is leaving matters too much to natives for safety, especially as to the packing of tea which should, I consider, be always done under European personal supervision. Native jemadars are very well for gardens of small area, and if the tea be packed at a central station.

Europeans of the class that are employed under Government, &c., as overseers, might advantageously be engaged more numerously for purely subordinate positions. There is little, very little, opening for young men of education in tea planting now-a-days unless they have plenty of money of their own, and for their own sakes I think it would be better if they would join in far fewer numbers and leave the under work to others who could do it equally as well and who would be more content to do it. Men of the overseer stamp, although in most cases not capable of being fully entrusted with important charges, are generally steady and attentive to their work, and, if married, usually settle down on a place very contentedly, while as a rule they know the language, and are handy at jobs of a mechanical nature.

Large *native* establishments are greatly to be deprecated. One duffadar can look after every batch of 50 laborers, and whether these are local or imported, the proportion ought not

to be less: one writer, if a good one, should be enough for the requirements of any garden, and with a jemadar or head duffadar, and mechanics, the native establishment should be complete.

It must be obvious that a manager or assistant who is responsible for a charge of 200 or 300 acres should not be burthened with much minute account keeping. In all such cases to manage his charge properly he should, if the garden is in full yielding condition especially, have a native English writer.

The essential point in management after that of the judicious direction of work is to know that the work is actually done, by the nirrikhs being honestly worked up to.

This I look on as almost the one great condition of successful management, and without this knowledge being accurate and regular, there can be no real safety, to say nothing of success. Every thing should be done, as much as possible, by nirrikhs.

It would be unwise to give fixed tasks in such work as early plucking of leaf, or, I think too, in pruning or transplanting, but these should be nearly the whole exceptions. Leaf-plucking is very easily tasked and the work easily ascertained, and so is all work done with the leaf or the tea, as actual quantities are dealt with, and they can be readily measured. Cultivation of land is more difficult to ascertain, particularly if there is any break even though slight in the supervision. I think all hoeing should be measured monthly.

In the present state of things it is somewhat difficult in places to make any reliable measurements with the null or tarr, but in all cases it should be done, and the planter should never content himself with daily visits to *look at the men in the field,* and then take it for granted that all is right.' I believe that, as stated under the heading "Cultivation." the division of a garden into small fields of 8 or 10 acres by an accurate compass survey would tend more to the correct measurement of work than anything else. In large gardens the

requisite number for so many acres could be told off and it would speedily be found out whether the men were working or not. In large factories well supplied with labour an 8 acre field might be hoed daily, the requisite number being assigned to a man.

I recommend every one to have his garden portioned off into small khets or fields, he will find it both to his convenience and interest to have this done.

I append a table of nirrikhs, and also a set of forms of accounts with remarks.

Remarks on the forms of Accounts.

Set A. 1. The forms of statement of expenditure is well adapted for a private garden, or for a garden of moderate requirements. It contains all the headings that are ordinarily necessary, although, in the garden of a limited Company, for instance, these headings would probably have to be increased to allow of such entries as "law charges" "interest and discount charges," &c., &c., and they would probably be subdivided under the distinctions of "Capital," "Revenue," "Capital A," "Capital B," &c. But these additions unless for specific purposes are quite unnecessary, and the statement should comprise all the requirements of, as I have said, a private estate.

2. The abstract shews in the first place the amount due for labour, *i. e.*, the amount of the pay list of the month, as distinguished from the "charges," which are items for which cash has been paid or is due in addition to the labour employed, the total of the whole, as seen in the first column, agreeing with the total amount of the statement of expenditure, which is thus divided into pay list and charges. The second column shews what is due, if anything, on both accounts, from the preceding month, and this being added to the current amount gives in the third column the whole amount due. The next column shews the amount of cash that has been paid in the month in these accounts and how, and this being

subtracted from column No. 3 there is shewn in the last column the amount due by the estate to employees; and also the amount due for goods supplied to it. In fact this column will shew the exact amount of the Factory's debts. The account is equally suitable for a public Company or a private Estate.

No. 3. This is the Cash Account, and needs no explanatory remark.

No. 4. The Store Accounts. These are divided into two statements, the Godown Account and the Coolies Account, the first shewing the account of stores purchased in the month, and the amount given out to the coolies, with the balances remaining in hand, the second shewing the position of the coolies as consumers of these stores. There is an entry, it will be observed, in the Cash Account, in the credit side of "Store Account," this is for cash expended in the purchase of stores, and the sum goes to the debit of the Godown Account; while, on the other hand the amount to the debit in the Cash Account (Rs. 100) is for cash paid by cashier for stores supplied to them, and it will be found in the Coolies' Store Account, under the column "paid by coolies this month." Unless two Store Accounts are kept, the transactions cannot be properly noted.

No. 5. Is the Advance Account, which will explain itself, but I would wish to say a few words on the subject of advances. At some factories any money given to a man *before pay day* is at once put down as an advance, this is indeed a very general custom, but it is an incorrect one, and often results in much confusion and at least in much extra writing to get matters straight. *An advance is, properly* speaking, money *given before any return has been commenced to be made in consideration of that money.* If any return is being made or has even been commenced, then money given in consideration is not *advanced,* but is money *paid on account.* Thus, if a cooly receives in *March* money to secure his services in

April, or if money is given to a ryot in August on condition that he will supply rice in December, both these sums are pure advances. But if a cooly who has worked for January and is still working in February, receives before the payment of his January wages a rupee, for instance, that cannot be considered in any light as an advance, in a correct sense, although it very often is so considered and written down as an advance, a method which is apt to lead to great confusion. Such payments as the latter ought to be entered in the abstract under the heading of "paid in this month," or better still the manager should make it a rule never to make such payments, and certainly anything that the cooly gets on account should be in the form of stores and not of *money*, and should be entered in the Store Account, to be paid for by him on pay-day. If any money given to members of the establishment, tea-makers, &c., on account should for preference be entered in the Cash Books under such a heading as Cash on Account and should be promptly recovered at the next pay-day, and by doing this the manager will certainly save much trouble from complications, re-entries, &c., anyhow he should never enter such sums as *advances*, as how can a man receive an advance with, probably two or three months pay due to him. For the same reasons it would be as sensible to put down the amount of stores given to the imported labours as "advances." In my opinion, save in very rare instances, the coolies should *never* figure in the Advance Account at all, whether imported or local. The first have no necessity of advances if they get supplied with stores, and they should as a rule never see money save at pay-day. The second class should not get advances as it is unsafe to count on their faithfully working them off—they should be paid after their work is done, and as they will seldom wait long for payment, it is best to make it daily or at longest, weekly. Advances should be confined to *responsible contractors* or made for *goods to be delivered*, and they should then be secured by proper

agreements ; as a rule when they are made to coolies there is no security whatsoever. Advances as made are of course entered in the Cash Account on the credit side, the corresponding column being the first in the Advance Account. They are seldom *recovered in cash*, but generally in "kind" the value of the return obtained being entered in the statement first, and then as paid for in the Abstract and Cash Accounts afterwards : the cash account being, of course, to equalise the double entry, first of the advance previously, and then of the value of the return, in the current accounts, debited with the amount of advance recovered, as "advances realised" the corresponding column for which is in the Advance Account, "realised this month" column No. 4.

The remaining accounts of the set need no explanation and they and all the other accounts with the sole exception of the statement of expenditure are equally suited to the requirements of a public Company or private estate. The statement of expenditure, as I have remarked before, would, for a Company, generally, be desired to be fuller, and the account marked B may be taken as a fair specimen of the form. It will be noted that there are two headings of "Cultivation" *old* and *new*, the latter being for the cultivation of plant to the end of the third year, after which time being supposed to be yielding a fair return, the cost is written under the heading of Old Cultivation, which thus stands for the cost of cultivation of all tea of four years old and upwards.

The cost of plucking leaf in these large statements is generally stated under the head of Crop Expences, as distinguished from Manufacturing. Under the heading Imported Labor some concerns enter the amount of the losses by death, though it is difficult to see how this can be considered as a *factory charge*.

In many accounts there is no mention made of *Sunday* leave, but as it is always given, I do not see why it should not be entered, instead of being, as is usually the case, divided

among the other items.

The Statement B is very generally in use in Assam, and I remember that when it was adopted, it was thought that it had supplied a long felt want, namely the exhibition in one statement of current expenditure together with the amount due for work previously done, the cash payments of the month, and the balance due to employees. It will be seen that the columns do shew this, but I cannot consider that the account deserves such eulogy as it has received. In the first place it does *not* shew the cash transactions properly in a correct sense, *secondly*, it is followed by no abstract, and lastly, although somewhat pretentious, it gives no more information of real use than the simple Statement of Set A. The way in which it shews the cash transactions incorrectly is this—it goes on the assumption that cash is paid separately for each branch of work, thus:—so much for hoeing land, &c., but unless to contractors, cash is *not* paid in this fashion. It is paid in monthly instalments to the coolies as per pay list, so much to the men, so much to the women, &c., for work done, which work is certainly taken account of and entered at the end of the month under the various headings of the Statement, but which is paid for in the lump by the scale of attendance of the whole of the laborers engaged in doing it.

By this account one would fancy that the coolies on pay-day received for instance *first,* Rs. 135-10-6 for hoeing, *secondly,* Rs. 255-3-9 for weeding and so on, instead of receiving their wages man by man as per the haziri work. In the same way the second column and last column do not shew what is due to the coolies or how, but what is due for work, and as I have said, there is no Abstract in the Set.

It shews little information in comparison with what it might do with its many columns, which in my opinion would be better filled with particulars of the total cost of each department of work brought forward so as to shew the actual cost of the working of the garden month by month, in pre-

ference to filling them with inaccurate cash transactions, which transactions could be shewn with perfect accuracy in an abstract. The account marked C. is one that I have never seen in use and is one of my own devising, but I think it would shew very thoroughly all that a Statement of Expenditure or Bill ought to shew, *i. e.*, the particulars and cost of work and charges of the factory for the month, and to these superadded the cost of the same for previous months of the year, the last column shewing the total cost both of each branch of work, &c., and of the factory for the year so far as it may have progressed. This form would I think be much more intelligible and useful to Calcutta Secretaries than the former intricate and inaccurate one, and much less troublesome to Managers. It would be followed, of course, by all the accounts of Set A. The *Abstract* of which Set would shew fully and clearly the payments of arrears, and the manager might add a few lines, at the foot of the whole, shewing the last column of the Abstract which would represent the liabilities; and on the other hand the amount of cash in hand, balances of advances and store accounts which would shew the assets of the month.

D is the daily haziri book. It should, if possible, be kept in the vernacular, the manager should at least post up or make his assistant keep the weekly work account, marked E, the totals of which for the month should agree with those of form D.

Form E. is a weekly account of work and its cost, being just a portion of the statement of expenditure, it may be said, but without any charges. After the third weekly form it is better to work the last one for ten days, thus : from the 21st to 30th or 31st. Sunday leave should not be calculated for those who appear in the statement of expenditure on fixed wages, as the establishment, syces, &c., as these are supposed to be always present, and it is better, as they do not work by task, to shew their salaries in full at one entry.

As regards Sunday leave it has to be given by the terms of agreement to imported laborers. Local laborers generally work by the day, though where they work as monthly servants, and are in the habit of taking leave on Sunday, their wages are generally calculated by a month of 26 or 27 days, thus securing them their full wages without paying them for Sunday, and making it an expensive matter to be absent on week days.

Tea-makers should not be begrudged a day's or half-a-day's leave in the week for they are the hardest work set on a garden beyond all question. They are generally allowed a half-day's leave either on Sunday or Monday.

F. This form is the Weekly Tea and Leaf Statement, and G. is a form of invoice, both of these forms being copied from books whose pages are counterparts.

Besides these there is of course a daily Cash Account Book, or Cash Book, but this it is quite unnecessary to treat of.

The forms given are fair samples of accounts and more should not be necessary, indeed so that they are clear and correct the fewer and simpler a factory's accounts are the better. The planter should always make himself aware of the expenditure of the estate weekly by making up the weekly work account in good time and by adding to its sum the weekly charges from the cash book. He should insist on those in charge of out factories sending in similar statements punctually, as in this way it will be seen in time how matters stand, and there will be time for retrenchment if needed.

A manager should keep in addition to the above accounts a Crop Value Statement, for his own information and guidance, the particulars of each invoice being entered on one side of the book, and the results as per account sales, on the other.

A.

Statement of Expenditure, of Factory for the month of March 1870.

Particulars.	No. or quantity.	Rate.	Rs.	As.	P.	Rs.	As.	P.
Establishment.								
Manager	...	......	300	0	0			
Assistant	...	......	100	0	0			
Writer	1	20	20	0	0			
Duffadars	6	5-8	33	0	0			
Chowkeedars	2	5	10	0	0			
Carpenters	2	7	14	0	0			
Syces and Grass-cutters ...	3	5	15	0	0	492	0	0
Cultivation.								
Deep Hoeing acres ...	170	5-8	935	0	0			
Nurseries ... days ...	120	5 per mensem	20	0	0			
Manure, purchase of 800 loads	...	2	100	0	0			
Cartage of do. per 14 mds.	...	6	21	6	10			
Purchase of 50 hoes ...	...	1	50	0	0	1,126	6	10
Manufacturing.								
Plucking leaf days ...	750	4 per mensem	100	0	0			
Purchase of baskets ...	200	2	25	0	0			
Rolling, roasting, firing, &c., and general tea-house work ...	...	......	100	0	0	225	0	0
Packing charges.								
Purchase of boxes ...	250	1	250	0	0			
Ditto of sheet lead ...	...	......	75	0	0			
Ditto of solder ...	...	......	8	0	0	333	0	0
Transit charges.								
Hackery hire on 25 chests	...	......	2	0	0	2	0	0
Building.								
Making new cooly lines ...	600	5	100	0	0			
Purchase of bamboos ...	...	......	20	0	0	120	0	0
General Work.								
Going to Station for money, clearing roads, &c., &c. days ...	180	5	30	0	0	30	0	0
Sunday Leave days ...	1200	5-4-3	165	0	0	165	0	0
General charges.								
Grain for cattle and horses	...	......	15	0	0			
Salt ditto ...	...	......	2	0	0			
Office paper, ink, &c. ...	...	......	3	0	0			
Postage	...	......	3	0	0			
Oil	...	......	2	0	0	25	0	0
			Rupees ...			2,518	6	10

A.—(*Continued.*)

Abstract *Factory* *March*, 1870.

Particulars.	Amount.	Balance due from last month.	Total.	Paid in this month.	Balance due.
Pay List.					
Manager ...	300 0 0	300 0 0	600 0 0	300 0 0	300 0 0
Assistant ...	100 0 0	100 0 0	200 0 0	100 0 0	100 0 0
Native Estbt. ...	92 0 0	92 0 0	184 0 0	92 0 0	92 0 0
Tea-makers ...	200 0 0	200 0 0	400 0 0	200 0 0	200 0 0
Coolies.					
Men ...	700 0 0	700 0 0	1,400 0 0	700 0 0	700 0 0
Women ...	300 0 0	300 0 0	600 0 0	300 0 0	300 0 0
Children ...	250 0 0	250 0 0	500 0 0	250 0 0	250 0 0
CHARGES.					
Cultivation.					
Manure ...	100 0 0		100 0 0	100 0 0	
Cartage of same	21 6 10		21 6 10	21 6 10	
Purchase of 50 hoes ...	50 0 0		50 0 0	......	50 0 0
Manufacturing.					
Baskets ...	25 0 0		25 0 0	25 0 0	
Packing charges.					
Boxes ...	250 0 0		250 0 0	......	250 0 0
Sheet Lead ...	75 0 0		75 0 0	75 0 0	
Solder ...	8 0 0		8 0 0	8 0 0	
Transit charges.					
Hackery hire ...	2 0 0		2 0 0	......	2 0 0
Building.					
Purchase of bamboos ...	20 0 0		20 0 0	20 0 0	
General charges	25 0 0		25 0 0	25 0 0	
Rupees ...	2,518 6 10	1,942 0 0	4,460 6 10	2,216 6 10	2,244 0 0

A.—(Continued.)

Dr. *Cash Account* *Cr.*

	Rs.	a.	p.		Rs.	a.	p.
To Balance	325	2	4	By paid as per Abstract	2,216	6	10
„ Remittance from Agents	2,000	0	0	„ Advances made	200	0	0
„ Tea sold locally	50	0	0	*Store Account.*			
Store Account.				Purchase of stores	150	0	0
Cash received	100	0	0				
„ Advances realised	150	0	0	„ Balance	58	11	6
Rupees	2,625	2	4	Rupees	2,625	2	4

A.—(*Continued.*)

STORE ACCOUNT.

No. 1—(Godown Account.)

Dr.		Cr.	
To value of stores in hand on 1st instant ...	50 0 0	By served out to coolies	125 0 0
,, Purchased this month	150 0 0	,, Balance	75 0 0
Total	200 0 0	Total	200 0 0

No. 2—Coolies' Account.)

Particulars.	Amount served out this month.	Balance due from last month.	Total.	Paid by coolies this month.	Balance due.
Local Coolies.					
Imported Coolies	125 0 0	200 0 0	325 0 0	100 0 0	250 0 0
Total	125 0 0	200 0 0	325 0 0	100 0 0	250 0 0

A.—(*Continued.*)

Advance Account *Factory* *March* 1870.

Particulars.	Amount.	Balance from last month.	Total.	Realised this month.	Balance due.
Kassiram, Jemadar, for manure	......	100 0 0	100 0 0	100 0 0	
B[illegible]tram, Hoeing contractor	200 0 0	150 0 0	350 0 0	50 0 0	300 0 0
	200 0 0	250 0 0	450 0 0	150 0 0	300 0 0

A.—(*Continued.*)

Labour Statement *March* 1870.

Particulars.	Men.		Women.		Children.		Total.	REMARKS.
On garden on 1st instant	200		100		60			
Since joined	50	250	30	130	10	70	450	These numbers are exclusive of Establishment 14 in number. Tea-makers 30 in ditto.
Loss								
By death	1		2					
By expiry of agreement	20		15		...	5	44	
Absconded	1	22	...	17	5			
Total	...	288	...	113	...	65	406	

A.—(*Continued.*)

Statement of Acreage under Cultivation.

Particulars.	In nurseries.	Plant in 1st year.	Plant in 2nd year.	Plant in 3rd year.	Plant in 4th year.	Plant in 5th year & upwards.	Extensions of this month.	Total.	Abandoned this month.	Total.
Indigenous ...	5	20	30	65	40	20	2	182		
Hybrid					60	40		100		
China						75		75		357
	5	20	30	65	100	135	2	357		

A.—(*Continued.*)

Tea Account.

Crop Statement.	Green leaf.	Tea	Tea Store Account.	lbs.	lbs.	Packed Tea Statement.	lbs.	lbs.	REMARKS.
Brought forward ...	8,000	2,000	Brought forward ...	7,000		Brought forward ..	5,000		
This month ...	16,000	4,000	Made this month	4,000	11,000	Packed this month	2,000	7,000	
			Despatched to Calcutta		2,000	Despatched ...		2,000	
	24,000	6,000	On hand ..		9,000	Balance ...		5,000	

FACTORY,
15th April, 1870.

Manager.

Blacksmiths.							
Carriage of Tea.							
oat hire							
teamer charge for freight ...							
Hospital charges.							

D.

Daily Haziree Book of ______ *Factory for the month of June* 1870.

Names.	No. of Days.	Rate.	Amount.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Remarks.
			Rs. A. P.																															
Totals ...																																		

Remarks.

The lower totals, or the sum total of each day should agree with the total in the weekly statement. The amount due to each man is put before the columns of days' work for convenience in paying, as one man's name, by having continually to look across the lines, is often called to another's wages.

Allowance to sick	2½	2½	0	5	3½	2½	2	18	5	3 0 0	
	1½	1½	0	1½	2	2½	1½	10½	4	1 6 5	
											4 6 5
Sunday Leave	0	0	1						10	0 5 4	
			56						5-8	10 4 3	
			193						5	32 2 8	
			130						4	17 0 0	
			40						3	4 0 0	
			20					440	2-8	1 10 8	
											65 6 11
Total hazirees per diem ...	490	465	458	483½	485½	490	473½				

N. B.—The totals of the columns of days' work should agree with those of the Haziree Book. No *charges* should appear in this account, but only the cost of work. Sunday Leave should not be calculated for the establishment.

F.

Factory.

Produce Statement for the week ending the 7th June 1870.

Date.	Green leaf gathered.	Tea manufactured.	Weather report.		Barometer.	Thermometer.	Remarks.
	lbs.	lbs.	A. M.	P. M.	In. ths.		
Brought forward							
1							
2							
3							
4							
5							
6							
7							
Total to date...							

G.

Season No. Invoice of chests Tea, the produce of Company Ld., and forwarded to Messrs. per steamer

Mark.	Chest No.	Break No.	Description of Tea.	Gross.	Tare.	Nett.	Remarks.
				lb.	lb.	lb.	

1870. } Manager

Table of Nirrikhs.

First clearing of forest land	20 square nulls	=2,880 square feet.		
Second do.	10	do.	1,440	do.
Burning and clearing surface of ground &c., &c.	10	do.	1,440	do.
Trenching grass land 18 inches deep ...	4	do.	576	do.
Deep hoeing ...	10	do.	1,440	do.
Light hoeing ...	20	do.	2,880	do.
Cutting weeds, grass, &c.	30	do.	4,320	do.
Cutting grass for thatching if not brought in by coolies, per man	120 bundles or poolas.			
per woman	100 do.			
If brought in by coolies per man	60 do.			
per woman	50 do.			
Ekor for walls	4 bundles.			
Plucking green leaf per man	8 seers			
per woman	7 do.			
Children proportionately to rates of wages.				
Picking tea	15 pounds.			
Making large leaf trays ...	3 in two days.			
do. small do. ...	1 per diem.			
Boxes	1 per diem.			
Leading boxes	8 to 10 per diem.			
A hackery load—				
Short distance	14 mds.			
Ordinary load	12 „			

Kutcha Bricks 1 rupee per thousand.

Average cost of the cultivation of an acre of Tea and the manufacture of its produce in the Dehra Dhoon, North-Western Provinces, the yield 3 maunds per acre.

	Rs.	As.	P.
Land rent	5	0	0
European supervision at 1-10 per acre per mensem	19	8	0
Native establishment, including mechanics at 7	5	4	0
* Hoeing—			
One deep hoeing	7	0	0
One light hoeing before the rains ...	2	14	8
Two light hoeings during the rains, to last till the cold weather	5	13	4
* Pruning	3	1	9
Manufacturing (Green Tea)			
Plucking leaf, 1,000 lbs., at 1 pice per lb. ...	15	10	0
* Rolling, roasting, &c., up to first colouring at the rate of 9 men to a maund of tea at 2-0-8	6	2	0
* Facing at 0-5-4 per maund	1	2	8
Thus a pan holds 9 lbs., and about 5 times this can be done per diem, each time lasting from 1½ to 1¾ hours.			
* Sifting at 0-2-7	7	10	0
* Fanning at 0-3-6 (woman's wages 3 per mensem)	0	10	6
* Picking at 0-1-6 per 14 lbs.	1	14	6

* These items include the allowance for Sunday leave.

Since writing this, I find from the manager's report that one of the largest estates here made 136,000 lbs. in 1870, at a cost at factory of Rs. 55,278-9-4 or 0-6-6 per lb. *excluding* lead, which taken at 4¾ pies would give 0-6-10¾, but the charge included freight to Scharanpore, which I calculate in the charges after leaving the garden, deduct this and the result at factory is 0-6-8¾ per lb.

	Rs.	As.	P.
Firewood—			
One maund requires about 1¼ hackery loads of dry wood, which at 0-4 per load equals 0-5, and cartage at 0-8 amounts to 0-15 per maund, or for three maunds ...	2	13	0
Building one year with another	2	8	0
Live stock needed for supervision ...	0	3	0
Tools	1	12	0
General work and charges	6	8	0
Boxes and lead, nails, solder, &c.			
Tea in the Dhoon is usually packed in 60 lb. half chests, which cost rupee 1, so that 4 boxes would be needed for 3 maunds=to 4 and to line a 60 lb. box from 3¼ to 3½ lbs. of lead are necessary which, with lead including carriage at 40 per cwt. is about Rs. 1-8 or 6 for 4, add nails, solder, &c., and say for 4 boxes.	11	0	0
Total	99	5	3

	Rs.	As.	P.
Cost at factory per lb.	0	6	7·46

A good average crop would consist of something like the fol-lowing proportions.

			lbs.	oz.
Young Hyson	25	per cent.	60	0
Hyson, ...	20	„	48	0
No. 1 Gunpowder	17	„	40	12
No. 2 „	10	„	24	0
Imperial, &c.	4	„	9	10
Hyson Skin	14	„	33	10
Dust	5	„	12	0
The loss would be	5	„	12	0
Total	100		240	0

The tea would sell in Calcutta at about as follows:—

	lbs.	oz.				Rs.	As.	P.
Young Hyson ...	60	0 @	1	1	0.	63	12	0
Hyson	48	0 @	0	15	6	46	8	0
No. 1 Gunpowder ...	40	12 @	0	15	0	38	3	3
No. 2 „ ...	24	0 @	0	13	0	19	8	0
Imperial	9	10 @	0	8	0	4	13	0
Hyson Skin ...	33	10 @	0	6	0	12	9	9
Dust	12	0 @	0	5	0	3	12	0
				Total		189	2	0

These prices would be good, especially for the lower kinds, but I have sold at better prices this season for the higher classes, 10,000 lbs. having brought, for Young Hyson Rs. 1-2-0 and Rs. 1-1-6, Hyson Rs. 1-1-0 and No. 1 Gunpowder Rs. 1-0-0.

Charges in Calcutta, and after leaving factory.

	Rs.	As.	P.
Freight to Seharanpore	2	8	0
Freight to Calcutta	11	8	0
Landing	0	12	0
Inspecting and advertising	3	0	0
Stamps	0	1	0
Brokerage and commission, @ 3½ per cent...	6	9	11
Cost of remitting to factory, @ 1 per cent...	1	14	5
Total	26	5	2

This sum deducted from the gross proceeds leaves Rs. 162-12-10 or annas 0-11-5 per pound on the average, which is about exactly what our green tea does although I feel confident that as we approach a better standard of excellence, our prices will rise considerably, for we have not hitherto produced such good green tea as Assam planters have black.

Adding the charges to the cost at the factory, the total appears as Rs. 125-10-5, being at the rate for production and sale of Rs. 0-8-9·81 per pound of packed tea, and shewing a profit of Rs. 63-7-7 per acre.

REMARKS.

It will be seen that land rent is far higher than in Assam; it is too high, in my opinion, for tea, but the price and rent of land are generally higher than in the latter province.

Fewer hoeings are needed than in Assam, the reason being the greater dryness of the climate, but from the same cause deep hoeing is rather dearer.

The cost of wood it will be observed is very high, but wood of all kinds is expensive in the Dhoon, and has always to be brought some little distance by hackery: there is little or no expenditure of *labour* however as in the manufacture of charcoal.

I have not counted anything for manure, which may probably surprise some who know the Dhoon, but I have not done so, because I believe that the gardens which are now giving from 1½ to 2 maunds per acre, and that without having been manured to any appreciable extent, would be now giving, had they been properly cultivated from the first, fully 3 maunds per acre under the same circumstances.

One of the largest gardens, in the Dhoon, which last year yielded 1¾ maunds per acre did not yield more because it has been hitherto evidently not well cultivated, and because its bushes are far too small for their age.

A few of the bushes in this garden have been allowed to grow as they would, as specimens I suppose. They are all touching and form a thick hedge at 5 × 5. The cultivated bushes that have been pruned, &c., &c., have about two feet of space between them at the same distance of planting, being not more on the average than three feet broad, and many not more than two feet.

If these bushes were of the size they should be, it is reasonable to suppose that they would have yielded at least a maund per acre more, and that without manure, seeing that they have had little or no manure as it is.

Manure in the Dhoon I regard as a means of increasing the yield over three maunds in first class gardens, and of bringing poor plant up to the three maund standard as rapidly as may be, but given bushes at proper distances and well cultivated, and I believe that three maunds would be the natural result.

Average cost of the cultivation of an acre of Tea and the manufacture of its produce in the province of Assam, the yield 4 maunds per acre.

				Rs.	A.	P.
Land rent				2	0	0
European supervision at Rs. 1-12 per acre per mensem				21	0	3
Native establishment, including mechanics, at 7 annas				5	4	0
Imported labour.						
	Rs.	A.	P.			
Proportion of cost for one year—						
One coolie per acre (including sick, weak, &c.)						
Original cost of importing, say Rs. 50	16	10	8			
Loss by death at 8 per ct. per annum	4	0	0			
Allowance in sickness, 1-10th of his time at half wages, or say ...	3	0	0			
Government fees, medicines, and medical attendance, blankets, &c. ...	10	0	0			
				33	10	8
Hoeing.						
* One deep hoeing...				6	0	0
* Four light hoeings				11	7	0
* Pruning				3	1	9

* These items include the allowance for Sunday leave.

Manufacturing.

	Rs.	A.	P.
Plucking leaf, 16 maunds, at Rs. 1-4 per maund	20	0	0
* Rolling (by machine, including wear and tear), roasting and drying off, at 15 annas per maund	3	12	0
Charcoal, 4 mds., at 7 annas, including carriage	1	12	0
* Sifting, at 2 annas	0	8	0
* Fanning, at 3 annas	0	14	0
* Picking tea at 14 lbs. for Rs. 0-2-6... ...	4	2	7
Building, one year with another	2	6	0
Live stock needed for supervision, &c. ...	0	6	0
Tools	1	12	0
General work and general charges (including cost of carriage of tea to ghaut)	7	8	0
Boxes and lead, nails, solder, &c.	16	0	0
Rs.	141	8	0

	Rs.	A.	P.			
Cost at factory per lb.	0	7	6·7			
Let us say that, losing about 2 per cent. in packing or say 7 lbs., 313 lbs. sell in Calcutta at 13 annas per pound, all round, this would give				254	5	0

Charges.

	Rs.	A.	P.			
Freight on 4 chests, at Rs. 2-12 ...	11	0	0			
Landing, inspecting, advertising, &c.	4	0	0			
Commission and Brokerage at 3½ per cent.	8	14	5			
Cost of remitting proceeds at 1 per ct.	2	8	8			
				26	7	1
				Rs. 227	13	11

* These items include the allowance for Sunday leave.

Adding the charges to the expenditure, the total cost would be Rs. 167-15-1, making the cost of production per pound Rs. 0-8-7, of packed tea, and the surplus over expended, Rs. 86-5-11.

To the charges, in the case of Companies, Secretaries' salary would have to be added, being at the rate of about 8 annas per acre.

REMARKS.

In drawing up this statement I have felt considerable diffidence, as it is now eighteen months, since, I left Assam, and I fear that my *data* may be somewhat time-worn.

It is, moreover, almost impossible to frame general estimates to agree with particular experience to any wide extent, (although they may be correctly presented in the average) and the more so when one remembers how unreliable estimates too frequently are as compared with actual results.

In the case of Assam the item of Imported Labour alone is one with which it is most difficult to deal with any great correctness : a healthy batch of coolies would not cost half so much to their employers as a sickly set, while, again, a garden worked chiefly by time-expired hands who had agreed to re-engage would be far less expensively worked than one with newly-imported people.

Nevertheless, I think on the whole the figures given will not be found much wide of the mark.

To some the cost of production may appear too high and the results too low, as I hear on reliable authority that several gardens in Cachar gave last season a return of one hundred per cent. on the outlay, while many planters in Assam have netted considerable profit ; but others may find, again, that their experience lead them to think differently.

In both this and the Dehra Dhoon Statement I have taken the areas as being in full bearing.

I have not put down anything for loss in coolies' provisions, as I do not think that there is any appreciable loss in

this way now that the health of the laborers is so much better than in former years, whereby they are enabled to earn their food at least, and for which they are now legally bound to pay prime cost.

I had several batches of new coolies under me just before leaving Assam, and I found that there was no loss on the average during even the first year on the godown supplies, and the coolies were very well fed. The price of rice may, however, have risen since I left, and another charge, freight on tea, may not now be the same, and if so, I must ask indulgent criticism on these as on other points, for I have taken them as they were about a year back.

In averaging the price of tea I have gone by the Calcutta market reports, a careful scrutiny of which shews that whenever there is a mixed shipment, which includes the broken kinds, the average usually is, despite the high prices for the finer sorts, from 13 to 14 annas.

Supplementary Notes.

Cultivation of hilly land.

I have been asked to add a few remarks on the cultivation of hilly land, as it was thought that my essay, coming from a "hill district" should have treated more specially of this.

The Dehra Dhoon, however, is *not* a hill district, and, moreover, my experience has been acquired chiefly in Assam, where the cultivation is all, with very trifling exception, on the flat, so that I can say little from *practical experience* of hill cultivation, but I have heard a good deal of it, and have seen it in other districts.

I am a great advocate for *undulating* land, but I should not counsel any one unless driven by necessity to open out on steep land, and unless one has fair soil and site, he should not in my opinion commence the undertaking at all.

I found in Chittagong that the plant on the hill was invariably inferior to that on level land, and this was looked on

there as a matter of course.

The great disadvantage is the loss of soil by which the roots with their spongioles are left bereft of nourishment and indeed exposed to the air and sun.

As a means of obviating this, terracing and draining are adopted. A method of drainage in vogue at one or two places in Chittagong is shewn in Fig. 31. It answers, I believe, but must be expensive.

Another way is to cut drains straight along the face of the hill as depicted in Fig. 32, carrying off the water by other channels into which the lateral drains fall. I have heard of a plan of preventing wash by laying bundles of the *ekora* or *kaggorah* reed between every fourth or fifth line of plants whereby, in addition, as the reed rots, a good manure is obtained. This I have from a very good planter who has both Assam and Cachar experience, and it seems to me worth trying. The same authority recommends the pick instead of the hoe for all teelah lands.

In terracing, regular steps are cut, much in the same manner as must have been noticed by visitors to the hill stations in the rice cultivation, &c., of the *paharees*. But my recommendation to these intending to plant out on hilly land would be like the famous advice once given on another subject— "don't": level ground or that slightly undulating, provided there be drainage, must always be vastly preferable.

Manure and its effects.

I wish to add a few words to the foregoing remarks about manure and its effects. (See page 342).

I have said that every factory should be possessed of a goodly number of cattle for the purpose, among others, of supplying manure, and I would now urge the importance nay the necessity, of their being *well fed*. The excrements of badly kept animals are, comparatively, almost valueless. The *free use* of *salt* will improve both the condition of the cattle

Fig. 31.

Hill drainage by lateral drains cut across the face of the hillock and falling into main channels. Some prefer the drains alone, believing that the channels carry off the most valuable washings. On the other hand, it is a practice when the hillock is rather steep to run only one drain or perhaps two, with a slight fall, from top to bottom, much in fact like the main channels above depicted.

Fig. 32.

Method of preventing wash by cuttings. The cuttings have to be cleaned out now and again, and they act beneficially by collecting wash.

themselves, and greatly add to the strength of their mauure.

The precaution of laying down plenty of dry earth mould or thoroughly rotted straw to absorb the urine both in the yards and sheds should never be neglected. The ammonia will be saved, its causticity will be neutralized, and it will be applicable as a *carbonate*.

I would recommend those who may not have been able to get a good herd together to try the effects of a green crop. In Assam a green crop of rice could in most places be very easily sown, and cut just at the time when the *ryots* would take it up for transplanting. In this way it would be applied immediately before the heavy rains came on, and it would thus be rapidly decomposed, and become easily soluble. The thicker the green crop were sown the better, and there is always abundance of waste land about every factory that could be made use of. Beans might at the suitable season be tried, and, doubtless, many other crops besides these, varying with the season and the district.

The planter should always bear in mind that although by *hoeing* his land he actually *manures* it by opening it to the absorption of ammonia from every shower that falls, and by promoting the formation of carbonic acid by the action of the atmosphere, still this as it were "goes without the saying," for unless he cultivated his land it would soon cease to be fertile at all, at least for his requirements ; and it should be his study to *add* to the natural manure obtained through cultivation by all the means in his power.

It is a good rule to apply the manure just beneath the extremities of the lateral branches, (putting it round the circumference of the bush in fact) well covered over with earth but *not* at too great a depth.

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Part II., Vol. III.

Correspondence and Selections.

Remarks on Saline Efflorescences on certain lands in Upper India; by LIEUT. J. F. POGSON, *Corresponding Member of the Society.*

Public attention has been recently drawn to the subject of *Reh* and *Oosur* lands, and remedies for their reclamation have been suggested.

It is strange that the *Oosur*, or naturally barren soil, which seldom contains saline substances, should have been confounded with the *kullur*, or sterilized soil, artificially produced by the over-irrigation of previously fertile land, and incorrectly called *Reh*, which is quite another thing.

As the subject is one of interest, I will, with your permission, supply some information which may perhaps be useful to the persons concerned, and be instructive to others who cannot at present tell the difference between a saline efflorescence which is productive of fertility, and another which produces sterility.

The Hindee and Sanscrit word *Oosur* simply means naturally barren land, and is quite distinct from lands which are unfit for the production of ordinary grain and root crops, in consequence of being overcharged either with common salt, or other saline matters in which it is present. The sterilizing powers of salt will be better understood when it is known that two per cent. of salt in the soil, will prevent its growing wheat crops, &c., &c. An inspection of the subjoined table will show the difference between a naturally fertile and naturally barren soil :—

Components.	Fertile.	Barren.
Organic matter	97·00	40·00
Silica (in sand and clay) ...	648·00	778·00
Alumina (in the clay)	57·00	91·00
Lime	59·00	4·00
Magnesia	8 50	1·00
Oxides of Iron	61·00	81·00
Ditto of Manganese	1·00	0 50
Potash	2·00	Trace.
Soda } as common salt ...	4·00	,,
Chlorine } as common salt ...	2·00	,,
Sulphuric Acid	2·00	,,
Phosphoric Acid	4·50	,,
Carbonic Acid in Lime and Magnesia	40·00	,,
Loss	14·00	4·50
	1000·00	1000·00

The true *Oosur* land will in composition very much resemble the *barren soil*, and the more clay (alumina) it contains the worse the soil. To improve such land is out of the question. The Hindee word *Reh*, means soil impregnated with fossil carbonate of soda; such earth is used for washing garments. The salt appears as an efflorescence, which when collected and operated upon yields soda, which the natives use in the manufacture of soap and inferior glass. This salt is a fertilizer, and may with great advantage be used as a mineral manure. The soil charged with it may be similarly used, being applied as a top-dressing to grain crops.

This explanation will show that there is no connection whatever between *Oosur* and *Reh* lands. The true *Reh* soil is very fertile, the *Oosur* hopelessly barren.

The Hindee word *kullur* means land which is barren and sterile from the presence of salt or saline matters containing common salt. The table given beneath shows the composition of *kullur* and *natron*, or *sujjee* :—

Components.	Natron.	Kullur.
Carbonate of Soda	22·44	28·674
Sulphate of Soda	18·35	34·642
Muriate of Soda	38·64	36·228
Iron and Alumina	0·00	0·092
Organic Matter	0·00	0·364
Water	14·00	0·000
Insoluble	6·00	0·000
	100·00	100·000

The analysis shows that *natron* contains 38·64 per cent. of common salt, and the *kullur* 36·22 per cent. thereof. In their natural state of combination *natron* and *kullur* may be considered as sterilizers. But if they could be decomposed, and the different salts of soda separated from each other, we should obtain three valuable saline manures, to wit, carbonate of soda, its sulphate, and muriate of soda or common salt. But there is no hope of this taking place, as the Indian salt laws will not permit of common salt being separated from other saline matters, and as the consequence the land revenue has to be sacrificed to the salt revenue.

The Salt Department looks upon salt as a condiment to be taxed. Scientific agriculture however, proclaims it to be a most valuable manure. When used alone, it increases the production

of wheat by 76lbs. to the acre, and makes the grain fuller and heavier, thus increasing the weight per bushel.

The most valuable manure we possess out of India is a mixture of $1\frac{1}{2}$ cwt. of nitrate of soda with 3 cwt. (4 maunds 2 seers) of common salt. This quantity applied to an acre of land increased the produce of wheat by $13\frac{1}{2}$ bushels of 59lbs each, and the yield of straw by 12 cwt. 3 qrs. 4 lbs. The actual weight in pounds was 800, or in Indian weight, 9 maunds 24 seers extra of wheat, and 16 maunds additional of bhoosa.

The Salt Department will not let us have cheap salt for agricultural purposes, and the land revenue suffers in consequence.

The nitrate of soda is common in Upper India; *i. e.*, between the Sutledge and Jumna. I believe it is called *shorkhar* and *shor-sujjee* by the natives, who may not touch it. Thus two most valuable manures are kept out of use by departmental obstructions.

This salt also appears on the soil as an efflorescence. When thrown on the fire it deflagrates, which *kullur* does not. The nitrate of soda, used as manure, without any salt, gave an increase of 602lbs. of wheat, and 10 cwts. 2 qrs. 24lbs. of straw.

The Sanscrit word *sujjee** means *natron*, and the soil impregnated with it is called *sujjee-mittee*, just as *Reh* soil is named *Reh-mittee*. It is by no means uncommon to hear the words *sujjee-mittee* applied to *Reh* soil. The difference however is very great. The one will form a soap with olive oil, and the other will not, nor will *kullur*. This if thrown on the fire will *decrepitate*. *Natron* appears as an efflorescence, on the surface of the soil, but is not accompanied by vegetation which is always the case with *Reh*.

The Hindee word *khara* means any solid or liquid substance which is saline or brackish to the taste. *Khar* by itself means potash, the word and preparation being peculiar to the saltpetre manufacturers. The sulphate of soda, when it appears on the soil as an efflorescence, will be called *khar* by any native who has tasted it, otherwise it will be denominated as *kullur*. The *kharee-neemuck* of the bazar is made from the *khar* soil. The sulphate of soda in its manufactured state, is of decided value as a manure. But the Salt Department prohibits the manufacture, as common salt is generally associated with the sulphate of soda.

Of the efflorescences named the carbonate and nitrate of soda are fertilizers. But the others, known as *sujjee*, *kullur*, and *khar*, are sterilizers so long as they remain in the soil, though under proper manipulation, all can be turned to account as valuable saline manure.

* *Sujjee.* The balls or lumps of manufactured impure soda sold in the bazars, is also called *sujjee*, and this article, when purified, is the *loutun* or *goolaubee sujjee* of the bazar.

The information I have supplied will I trust be useful to the European planter and settler, and enable him to distinguish and make use of saline efflorescences, but as far as the ryot and zemindar are concerned, agricultural prosperity cannot take place with money at 37½ per cent. compound interest, a salt duty of £8-15-6 per ton, and high prohibitive duties on all saline manures.

In conclusion, I would wish to observe that whilst the task of trying to reclaim lands sterilized by *kullur* by surface and sub-soil drainage, is labour and money thrown away; there is nothing whatever to prevent these lands from yielding a high revenue, for years to come, (or until the *kullur* is exhausted,) if they were ploughed and sown with the seed of the *salspla soda* plant, which when harvested, dried and burned, yields a saline ash, containing 20 per cent. of carbonate of soda, and constitutes the *barilla* of commerce, which is in great demand in England and America for the manufacture of superior soap.

The plant is called *lana* by the natives, and is indigenous to India, and grows in that part of the Delhi district where the Jumna canal discharges its waters, and runs to waste.

In my previous communication, on the subject of *Reh* and *Kullur*, I laid before your readers an analysis of *Kullur* as compared with *Sujjee* or Natron.

I have recently been arranging my papers, and amongst those for 1865, I found a London analysis of *Reh* which was copied from a printed official report on *Reh* and *Kullur* sent for my perusal by the Lieutenant-Governor of the Punjaub.

A consideration of the analysis given beneath will show how much *Reh* differs from *Kuller*, and will, I trust, convince the reader, that as stated by me, the former is a fertilizer, and the latter a sterilizer.

Analysis of Reh (soil) from the Western Jumna Canal.

	Reh.	*Kullur.*
Organic matter	6·61	0·364
Silica	54·46	......
Alumina	4·47	......
Lime	2·93	......
Magnesia	1·49	......
Oxide of iron	3·30	0·092
Potash	1·84	......
Soda and common salt... ..	11·85	64·902
Sulphate of soda	0·00	34·642
Sulphuric acid	6·06	......
Phosphoric acid	Trace.	......
Water or loss	7·40	......
(By Professor Anderson of London)	100·41	100·000

The *Kullur* contains 28·674 of carbonate of soda, and 36·228 of common salt. The sulphate of soda so largely present therein contains in every hundred parts 19·25 of soda, 24·75 sulphuric acid, and 56·00 of water. The common salt is a compound of 60 parts of chlorine and 40 of soda=100. The reader, if conversant with agricultural chemistry, will see that this *Reh* soil only requires to be *limed*, to make it most productive. The common salt which is over-abundantly present, requires to be decomposed by the action of lime, which would take up its acid, (chlorine) and set the soda free. The land would now produce heavy crops of turnips, potatos, or rape, followed by maize or large millet, (*Jooar*), and when these were removed, barley would follow, with maize as a summer crop. The land after this was harvested would be sufficiently sweetened to grow wheat and all other winter crops. It would require four tons, or 108 maunds of slaked lime (*chunam*) to neutralize the injurious effects of the common salt. This at the very highest rate would cost Rs. 54, but the outlay would very speedily be repaid. The genuine *Reh* soil requires no *liming*, though if manured with the *phosphate of lime*, the grain produced would be so superior, as to be fit for the London market. At present Bengal wheat is unsaleable in England, but by improving its quality, we might in a few years drive the *Odessa* wheat out of the market.

The following extract connected with *Reh* soils still further illustrates their value, and shows how easily a revenue officer may be imposed upon if not conversant with the nature and composition of saline efflorescences.

" Such are some of the soils in India, which by washing, yield from 1 to 7 per cent. of saline matter. Thus in several Indian soils examined by the late Mr. Fleming of Barochau, there were contained in 100 parts.—

	1°	2°	3°	4°	5
Carbonate of lime	$7\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$	4	2
,, of magnesia... ...	$3\frac{1}{2}$	2	$0\frac{1}{2}$	1	—
Saline matter (chlorides, sulphates and nitrates)	1	$1\frac{1}{2}$	$3\frac{1}{2}$	3	7

No. 1 was near Gya in south Behar. Never lies fallow, is covered with water during part of the rainy season; produces from 30 to 50 bushels of wheat per acre.

No. 2 same district. Not inundated by the rains; produces wheat, peas, cotton or poppy in the dry, and Indian corn and millet in the wet season. Sometimes manured with wood ashes and cow-dung.

No. 3 from North Behar, Tirhoot. Deep loam, yielding two crops yearly. Not flooded, 25 to 30 bushels of wheat per acre.

No. 4 Tirhoot. Light-coloured soil, and not so productive as No. 3. Saline efflorescence in patches.

No. 5. Tirhoot. Still less productive; nearly sterile in places from saline efflorescence, except in the rainy season, when it produces good crops of Indian corn.

From these examples we see that from 3 to 4 per cent. of saline matter may exist in a soil in certain circumstances, without rendering it unproductive. More than this, however, few soils can contain, and yet continue productive. Where such large quantities occur, the saline matter ought to be washed out and carefully analysed. A large proportion, where the soil continues fruitful, will usually prove to consist of the nitrates of potash, soda, or lime. (*Vide Professor Johnston's Instructions for the Analysis of Soils, pages* 62, 63.)

The soil No. 4, if treated with *kunkur* reduced to powder, would at once be restored to fertility, and if after this application, the efflorescence appeared, the patches should be treated with slaked lime, in the proportion of one seer to the square yard of saline patch.

The soil No. 7 would require four tons of slaked lime to the acre, and the lime should be slaked with water holding saltpetre in solution. Three *maunds* of nitre would be required. It has been shown that *salt* and *nitrate of soda*, acting together, produce the best saline manure, and the heaviest wheat crops. The nitrate of potash or saltpetre will do the same. I trust this information will be of value to the Tirhoot European landed proprietors.

I have alluded to the phosphate of lime as being greatly needed for the improvement of all our grain crops, and especially so for wheat.

The wheat of Central Spain is best suited to our climate, and if once introduced would speedily displace the inferior wheat at present cultivated. The problem before the European planter is this. Is it worth while producing from 30 to 50 bushels of first-class wheat per acre, for sale in the London market, or is it not?

The bushel of wheat weighs on the average 60 lbs.: and the quarter 480 lbs., or *maunds* 5, seers 31¼, and 800 grains. The average price of wheat was in 1869, 48*s.* 2*d.* per quarter, and the average for 1868 was 63*s.* 4*d.* per quarter. In 1869, Russia supplied England with 7,761,915 cwt. of wheat, and in the previous year, our next door neighbours of Egypt, sent over 3,178,675 cwts. of wheat to London. During the year 1869 England purchased 32,648,951 cwts. of wheat towards which enormous quantity India did not contribute a single ton, and yet with proper management we should be able to cut out Russia and America, who between them supply us with 18¾ million cwts of wheat. The information supplied will enable the European landed proprietor and planter to decide whether wheat

farming will suit his books or not. My own opinion is that it will, provided he can be supplied with the phosphate needed at a cheap rate.

The fossil phosphate of lime exists in the *Sewalicks* in the greatest abundance. The supply may be said to be almost incalculable, but *unless private enterprise* enters the field, and subscribes capital for quarrying and utilizing this most valuable *fertilizer*, the mineral wealth brought to notice must and will continue to be neglected. To show how much this phosphate is valued by the British farmer, I have only to refer the reader to the London *Spectator* of the 30th September last, in page 1186 of which he will find the Prospectus of the new Sombrero Phosphate Company, capital £130,000, with power to increase. The island of Sombrero in the West Indies has been leased to this Company by the Crown at a rental of £1,000 per annum.

"The phosphate of this island is of the highest quality, and commands a ready and preferential sale at £5 per ton, at which price the present proprietors are refusing contracts, on account of the upward tendency of the markets."

The fossil phosphate of lime of the *Sewalicks* is superior to the above, the bones of antediluvian and existing animals being found imbedded in the matrix, which in consequence must also be rich in phosphates. This mineral contains in 100 parts 45·05 per cent. of lime, and 45·95 of phosphoric acid.

The phosphate of Spain, according to Doctor Wallaston, contains 48·5 of lime and 51·5 per cent. of phosphoric acid, and, as in the *Sewalicks*, entire hills are formed of it.

One hundred pounds of the ash of the grains of wheat contain 46lbs. of phosphoric acid united with 3lbs. of lime, 12lbs. of magnesia, 1lb. of oxide of iron, and 31lbs. of potash and soda. Of sand or silica there is but 1lb. and of chlorine 6. Total 100.

The soils of Tirhoot and other productive *Reh* soils are rich in everything but the *phosphate of lime*, and as the natural consequence, the grain produced (wheat) is of inferior quality. Let the best Indian wheat be analysed, and it will be found that silica or flint is the principal mineral matter present therein. It was but the other day that the European miller in charge of the Cawnpore steam flour mills, positively refused to grind a sample of wheat for fear of injuring the mill stone. This *flinty wheat* if sown on land suitably manured with phosphate of lime would cease to be flinty, for wheat only assimilates or *takes* up *silica*, when the proper substances are wanting. One hundred pounds of wheat straw ash contains 66lbs. of *silica*, and only 5lbs. of phosphoric acid. The grain is fed by the stalk, the stalk by the roots, and the roots by the soil. Hence it follows that if the soil is deficient in phosphates, soluble *silica* will as far as possible take their place, and produce flinty wheat, Indian corn,

&c., &c. The Indian agriculturist (ryot and zemindar) may thank his stars that for eight months out of the twelve, the country teems with creeping things and insect life, whose birth, life and death, keeps up a small annual supply of phosphates in his fields, but for which, a general failure of crops would be the order of the day. The discovery of the great ossiferous deposits of the *Sewalicks*, is due to Baker, Durand, Cautley, and Falconer. They are distant, some 25 miles from Saharanpore westward of the Jumna river, and when worked the fossil could be brought by boats, *viâ* the Western Jumna Canal, to the railway which crosses it. From this point it would be carried by rail to the Ganges Canal, and thence by boat to the Jumna termination of that Canal, where a depôt would be formed. The fleet of boats belonging to the company would take in cargo at this depôt, and after passing Allahabad, would supply the demands of the planters of Mirzapore, Benares, Ghazeepore, and all other river stations between it and the *Soonderbunds.* If the question is taken up, and a company formed, I shall on some future occasion show how the mineral may be used without dissolving it in the sulphuric acid.

New method of cultivating Potatos introduced by the Reverend Doctor Wrenford *of Nairn.—Communicated by* Lieutenant J. F. Pogson.

[I send herewith a paper on potato culture, which I shall feel much obliged by your submitting to the Council of the Agri-Horticultural Society, for consideration and publication if approved of.

The potato contains 75 per cent. of water—and if by some simple process of drying, 50 per cent. of the water could be driven off, I think the tubers would keep well.

My idea is to dip the washed roots in a hot alkaline solution for a certain time, so as to destroy all vitality without cooking the starch. This done, they should be allowed to dry in the sun; and then be kiln-dried at 135°F. The skins will not be removed. Such dried potatos may be kept packed in chopped straw, and when required for use, they will have to be soaked in water, and may then be boiled, or roasted at pleasure. If well dried, they might be reduced to a meal.

If the plantain can be dried I see no reason why the potatos cannot be similarly treated. Want of funds, prevents me from undertaking the experiment, but if provided with them, I am certain I could carry out the project.]

"Doctor Wrenford has made some valuable experiments in the growing of potatos last year (1869.) He planted an ordinary

"*Regent,*" six inches deep, and the earth was raised about it, until it became a mound 2 feet high. The plant flourished amazingly, and its haulm, *pegged down*, covered a space of six feet by nine feet. The yield was forty-four fine potatos, weighing eighteen and-a-half pounds. This year, eighteen of these roots were planted in the ordinary method, and yielded 55lbs. (*fifty-five pounds*), but the drought interfered with the crop. The remaining twenty-six were planted so deep, that the dry weather did not affect them." They were planted as follows :—" A pit was dug three feet deep, and manure and soil put in, reducing it two feet. The potatos were planted whole in this pit, covered with two inches of soil, and as they grew, the pit was gradually filled up to the surface, the haulm being pegged down as before. When the crop was dug, six hundred and twenty-seven (627) tubers were produced, weighing three hundred and twelve pounds and twelve ounces.

" The largest potatos weighed 2 lbs. 2 oz., and *eighty-one* were over one pound each. The others varying in weight from 2oz to 10 oz. Of the entire crop, fifty-seven only were small, *i. e.*, from 1oz. to 1½oz. in weight. This result amazed the North countrymen greatly, and the success of the experiment appears to be due to the deep planting."

The above appeared in the *Illustrated London News*, of the 22nd October, 1870, and had Dr. Wrenford experimented on the more prolific varieties, still more satisfactory results would, I think, have been ensured.

As potato culture is at present attracting some attention in India, the system devised by Doctor Wrenford might advantageously be tried in our Hill stations. There are very few houses in the hills without a small flower garden, and as digging a circular hole, three feet in diameter, and as many in depth, and filling it subsequently with manured garden soil, would not cost two annas (*three pence*) each, the most economical person might plant six potatos, with a fair chance of obtaining a good supply of tubers for use, and distribution of the small ones as seed.

In England, under the old system of cultivation, an acre of land produced on the average eight tons, or 216 *maunds* of potatos, but under the German and Wrenford system, the production of roots seems to depend, first on the quantity of plant food, to be met with within a given circle, and *secondly*, on the natural productiveness of the variety under cultivation.

The experiments of the Revd. G. Hopton Scott, (of the Vicarage, Gringley on the Hill, " Axholme") concluded in November 1871, show most conclusively, that the poor man would come to considerable grief, if he cultivated potatos which the rich only could afford to grow.

This gentleman experimented on twelve kinds of potatos, using one pound of each for sowing. The result is given below.

		Produce.		Cost per pound at Carter's shop, London.
		lbs.	oz.	
1.	Ash-leaf kidney	7	12	
2.	Holbery's kidney	8	15	
3.	River's Royal ash-leaf ...	10	14	
4.	Myatt's prolific	12	0	
5.	Prince of Wales kidney ...	6	6	
6.	American rose (London) ...	20	0	9*d.* per lb.
7.	American rose (own seed) ...	33	1	
8.	Patterson's Victoria... ...	Mostly bad.		
9.	Red Rounds	8	8	
10.	Dunbar Regents	13	12	
11.	Bovinias	31	4	8*d.* per lb.
12.	Red-skinned Flour Ball ...	40	5	5*s.* for 14 lbs.

The superior crop is thus described. The "Bovinias" have produced 31lbs. of tubers, the large ones ranging in weight from 1lb. 2oz. to 3lb. 3oz. each,—amongst the crops was a monster, weighing 7lbs. 14oz. The "*Red-skinned Flour Ball,*" has produced 40 lbs. of tubers from one pound of seed potato, and the "*American Rose Potato,*" has given 33 lbs. for one put down.

I am indebted to Major Shelley for the above information, and in reference to the "*Climax,*" potato introduced by him, I beg to state that four of my largest, weighed just over one *seer*, and three of the next size, a little over one pound, four ounces. I observe that the "*Climax,*" now costs 9*s.* 6*d.* for seven pounds, or 1*s.* 6*d.* if taken by the single pound. The potato is well worth the money. It is a perfect beauty to look at, and produces a good crop.

I think if the Society would order out a good supply of the "*Bovinia ,*" "*American Rose,*" and "*Red-skinned Flour Ball,*" that the public would be very glad to pay for the seed potatos.

It appears most singular to me that the Indian Revenue authorities, when making *new land Revenue settlements*, do not stipulate with the zemindars to grow potatos, as a regular crop. The seed in the first instance being supplied from model farms, free of cost. The potato, English Field Bean and Field Pea, are legitimate *Field crops*, producing on the average respectively, 8 tons, or 216 *maunds* ; 1,980 lbs. or 23 *maunds*, 34 *seers*, and 1,160 lbs. or 14 *maunds* $5\frac{3}{4}$ *seers*.

It cannot be said that, raising such crops would ruin the *Ryot*, for as far as I can judge from a critical examination of official documents published by authority, it is the want of these crops that is impoverishing the zemindar, and the soil as well.

The subjoined table is drawn up from an official Ganges and Jumna Canal Report, in which the condition of the irrigated land is thus proclaimed.

"The financial results of the year display an unexampled prosperity."

Table.

Crops.	Acres irrigated.	Maunds Produced.	Produce per acre.			Value of market or retail price.
			Mds.	Seers.	Chts.	
						£
Sugar ...	97,553	2,009,329	20	23	14	1,056,385
Wheat ...	597,936	7,916,186	13	9	9	2,635,505
Barley ...	257,509	2,680,006	10	16	$4\frac{3}{8}$	486,250
Rice	111,020	1,142,152	10	11	8	387,146
Maize... ...	42,122	353,547	8	15	$11\frac{7}{8}$	82,699
Millet... ...	93,369	690,693	7	15	$14\frac{1}{3}$	170,108
Pulses ...	73,354	601,574	8	8	$0\frac{5}{8}$	173,532
	1,272,862	15,393,487		Total		£4,991,625

In the West Indies, Mauritius, and elsewhere, one ton, or 27 maunds of sugar, is considered a very low crop, and three tons an average one. As regards wheat, His Excellency the Viceroy has caused Major Corbett's Report to be published, and from it we learn that in the district of Budaon, without canal irrigation, the Major has produced "nearly 23 bushels per acre," and the zemindar who used water at discretion "a little over nine bushels per acre," whilst the prosperous Ganges Canal zemindar obtained no less than 18 bushels $5\frac{1}{2}$ pounds per acre.

The average wheat crop of England is 15,000 lbs. per acre or 25 bushels, which might be produced all over India, with and without irrigation, if comparatively deep ploughing, and suitable manure was made use of. The cultivation of the potato, would compel the ryot to dig up the soil, to harvest his crop, and in doing so he would break up the *pan* or "*towa.*" This land when ploughed, would yield very much better crops, and the ryot would thus learn a lesson on the value of deep digging and ploughing.

The crops indicated will always command good prices, and with the money so acquired, better or higher cultivation of wheat and sugarcane, becomes quite feasible. The field pea and bean, as cattle food, are far superior to gram, and as soon as a simple plan for drying potatos shall have been discovered, the ryot will be able to keep a store of food on hand, which is at present not in his power, even if he had the inclination to do so.

Umballa, 13th January, 1872.

Monthly Proceedings of the Society.

Monday, the 25th September, 1871.

DR. C. FABRE TONNERRE, V. P., *in the Chair.*

THE Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Ordinary Members:—

Messrs. W. F. Graham, M. C. S., J. R. Forbes, WM. Harlow, Rajah Madho Rao, Capt. P. S. Marindin, Capt. G. B. Worsley, Mrs. Annie Fox, Huzrut Noor Khan, Capt. F. H. Woodgate, the Commandant of the Erinpoorah Irregular Force, Messrs. C. G. Master, M. C. S., WM. DeCourcy Ireland, James Craven, Dr. T. Ffrench Mullen, Major A. E. Campbell, Baboo Gopinath Roy, Capt. A. C. Padday, and the Superintendent of the Patna Lunatic Asylum.

Honorary Member.—Mr. John Scott, Curator of the Royal Botanic Gardens, Calcutta.

The names of the following gentlemen were submitted as candidates for election:—

A. F. Wilkinson, Esq., Manager Tellary Concern, Shahabad,—proposed by Mr. J. J. Guise, seconded by Mr. T. H. Mosley.

W. J. Greenwood, Esq., Assistant Commissioner, Lullutpore,—proposed, by the Secretary, seconded by Mr. W. H. Cogswell.

D. W. Ritchie, Esq., Officiating District Superintendent of Police Chyebassa,—proposed by Dr. S. J. Manook, seconded by the Secretary.

Capt. W. Barron, Deputy Superintendent Revenue Survey, N. W. Frontier, Murree,—proposed by the Secretary, seconded by Dr. Tonnerre.

Major A. F. Corbett, District Superintendent of Police, Budaon,—proposed by Mr. R. J. Crosthwaite, seconded by the Secretary.

Dr. H. A. Kidd, Civil Surgeon, Mundla,—proposed by the Secretary, seconded by Mr. Cogswell.

C. F. F. DeHoxar, Esq., Indigo Planter, Allahabad,—proposed by Mr. S. Jennings, seconded by the Secretary.

J. Blanchett, Esq., Registrar General's Department, Allahabad,—proposed by Mr. F. G. Mayne, seconded by Mr. J. W. Sherer.

Manager Government Garden, Fyzabad,—proposed by the Secretary, seconded by Dr. Tonnerre.

The Deputy Commissioner of Bassim, West Berar,—proposed by

Lieutenant Colonel W. Nembhard, seconded by the Secretary.

Rejoined.—A. B. Patterson, Esq., C. S., Futtehpore.

The following contributions were announced:—

1. Journal of the Agricultural Society of N. S. Wales, for July 1871,—from the Society.

2. A brief History of Bengal Commerce, from 1814 to 70, from the Author.

3. Report on Kew gardens for 1870, from Dr. Hooker.

4. Records of the Geological Survey of India, Vol. 4, Pt. 3, from the Government of Bengal.

5. The *Flora Sylvatica* of S. India, part 12, from the Government of India.

6. An assortment of Australian seeds, including the "Jarrah" or Australian Mahogany, and several species of Gum tree, from Dr. Geo. King.

7. A quantity of maize seed raised at Port Blair, partly from seed received from the Society and partly from acclimatized seed,—from Capt. M. Protheroe.

8.—A small quantity of seed of English Dandelion, from Mr. H. A. Harris.

(All the above seeds are available to Members.)

HORTICULTURAL NOTES.

Col. J. A. Wright, writing from Morar, in respect to the receipt of a supply of cuttings, gives the following as a successful mode of treatment, which may be useful to many residents at dry Stations.

"I beg to offer you my best thanks for the large supply of cuttings received. Although the weather was extremely hot and dry on their arrival, and has continued so since, I have every hope of their striking, in consequence of a very large portion having reached me in splendid condition, from the perfect packing, and care bestowed on them when despatched; all the roses were as fresh as when cut, and some of the more succulent cuttings had thrown out little rootlets. They began to droop so much in spite of every precaution, after planting, that I plunged the pots, containing white sand and a little charcoal, in a bed of fresh manure, covered with six inches mould, and then 6 inches sand; with glass over the more delicate ones, and a thatch above all; they now look as fresh as on first arrival."

In a subsequent note Col. Wright observes:—"With reference to your question, in your letter received on the 9th instant, I shall be very happy if you think the plan I have adopted for the cuttings, worth a trial by any one; it certainly has answered very well in my case, and the majority are still doing well. Pray make what use you may think advisable of my note; I have never tried it before for cuttings; but for many years have found it a most successful plan to plunge pots of seed, which otherwise generally here fail, in a similar hot bed, but omitting the upper layer of sand and

earth; I found the manure alone too hot for the cuttings: I have never been able to raise a plant of Lavender, Sage or Thyme here, without the plants damping off when very small, until I tried this plan, and it answers for many seeds which are very difficult to raise."

Mr. S. Jennings, writing of certain gardening operations which he is conducting in the Khoosro Bagh at Allahabad, gives the following description of a raised bed which seems to answer well the purpose for which it is intended: "Just now I have a raised bed in the garden which is the admiration of every body. It is in three tiers of a triangular shape, the lowest about 10 feet on each side; the earth banked in with vitrified brick. On this are planted Ferns, some in amongst the rock work; the middle tier is a mass of purple and blue Achimines, in profuse flower; the upper tier is covered over with rock work, in the centre of which is a single plant of Calamus, with its graceful leaves, around the root and all over the rock is *Tradescantia zebrina.* The *tout ensemble* is so good that I mean to extend the use of this particular style of raised beds. In the cold weather they are well adapted to show off such low growing plants as Violets, Verbenas and bulbs. This is the first time I have ever used Achimines for the open border, and I know nothing that equals it for the rains."

Dr. Beaumont, Residency Surgeon at Indore, thus alludes to his treatment of *Clianthus Dampieri,* a plant which, though so handsome, is very scarce in our local gardens: "I think it would be well to bring to notice the mistake made in growing the *Clianthus Dampieri.* As a rule it is killed by coddling. In October or November it should be sown in an open border freely exposed to the sun, and, if not transplanted or interfered with, flowers freely and to a certainty. The roots are so fine and easily broken that to transplant is to kill the seedlings."

The Secretary brought to notice that having received several complaints from Members, of seeds having failed to germinate, consequent on the unusually damp season recently experienced, he had referred to Mr. Scott (who had reported so favorably on these seeds, on their first arrival) and who now recommends the following treatment. It is particularly requested that Members who resort to this treatment will favor the Society with the result of their experiments. It may be added that some Members who found these seeds to germinate most freely in the first setting in of an unusually early rainy season had since been disappointed in their subsequent sowings, proving that the seeds had been affected by damp or atmospheric influences arising from long and continuous rain. Mr. Scott writes, "I would suggest that Members be recommended to put a little *quicklime* into each packet, and keeping all of course in a dry and airy room until they sow. The quicklime (which has such a strong affinity for carbonic acid) will at once act upon the seeds and remove the superabundance of carbonic acid, which they have absorbed in a moist

atmosphere. By adopting these simple precautionary measures, I do not doubt that the result of germination will be much more satisfactory."

GRANT OF A PIECE OF GROUND FROM GOVERNMENT FOR A GARDEN.

Submitted the following correspondence on the above subject;

From the Council of the Agricultural and Horticultural Society of India, to the Secretary to the Government of Bengal, dated 20th December 1870.

Sir,—We, the undersigned, representing the Council of the Agricultural and Horticultural Society of India, have the honor to request that you will submit, for the favorable consideration of His Honor the Lieutenant Governor of Bengal, the following representation and requisition from the Members of the Society.

2. On the 3rd February 1864, the Society addressed you on the subject of a grant of a piece of land from the Military Orphan Society's premises in lieu of the ground at the Botanical gardens then about to be resumed by the Government, setting forth fully the position of the Society and the services it had rendered.

3. Under cover of his docket, No. 3102 of 20th July 1864, the Junior Secretary, Mr. S. C. Bayley, forwarded a correspondence with the Government of India which shewed that the Military Orphan Society's premises had not then been made over to the Government of India and that the Government of India was unable in consequence to move in the matter.

4. On the 1st November 1864, the Junior Secretary to the Government of Bengal, Mr. S. C. Bayley, forwarded copy of a letter from the Secretary to the Government of India, Home Department, No. 3127, of 6th October 1864, to your address, offering the land between the Allipore and Kidderpore bridges on certain conditions. A further communication was received dated 8th February 1865.

5. These two communications were acknowledged in the Society's letter, dated the 28th February 1865, the offer being respectfully declined on the ground of the terms attached to it. The more potent reason for declining the offer, though not then stated, was the condition which forbade any nursery garden being made. The great usefulness of the Society is dependant on its having an experimental garden, which was impossible under the condition referred to.

6. From that day to the present the Society has been using every endeavour to obtain an eligible site for an experimental garden but has been unsuccessful in its endeavours.

7. The utility of the Society has been so crippled by the want of a garden (for without a garden it is impossible to do any thing in the way of growing experimental crops or in improving the culture of fruits) that the Society respectfully venture to make one more appeal to Government for

assistance in obtaining a suitable piece of ground.

8. Such a piece of ground is, we believe, at present available at Allipore, to the south of the Ha-ha fence, which bounds the ground attached to Belvedere.

9. The Society is not aware whether this land has been appropriated to any particular purpose, but if it could be diverted from the purpose to which it may be intended to apply it hereafter, the Society would respectfully solicit the grant of this land in perpetuity, in return for which the Society would be willing on its part to forego altogether the annual grant of Rs. 5,000 which it at present receives from the Government. The Society is of opinion that were this land made over to it, the small funds of the Society would just enable it to lay out a garden, and its annual income, together with any proceeds it might receive from the sale of grafts, &c., would enable it to stock and maintain the garden on a proper footing, as well as to distribute agricultural and horticultural seeds as at present.

10. The Society is well aware that it is asking the Government for a valuable piece of ground; at the same time it offers to forgo a grant which represents a considerable amount of capital, and without which were it compelled to purchase ground out of its own funds, its very existence as a Society would be imperilled, for its annual income would not allow of the ground being properly laid out, stocked and maintained, as also disable it from issuing the annual supply of seeds, agricultural and horticultural.

11. The great good that the Society has effected in time past, has been owing to the land which it had occupation of in the Botanic Garden. That it has not done more since has been owing to the resumption of that land in the first place, and the impossibility of getting ground in a favourable position except at a cost quite beyond its means.

12. The present proposal on the part of the Society is one which appears to it to have this advantage over any that has been made before, *viz*, that the Government can allot a piece of ground which is at present unutilised, the cost of which to Government, it is believed, represents only about 13 years purchase of the grant which the Society offers to relinquish, a grant too which if capitalized would represent considerably more than what the ground originally cost. The minor advantage of having a well kept garden, even though an experimental one, contiguous to the ground of Belvedere, the residence of the head of the Local Government, is so self evident that it requires no further remark.

From H. S. Beadon, Esq., Officiating Under-Secretary to the Government of Bengal, to the Secretary to the Government of India, Home Department,—(No. 124, dated Fort William, the 12th January 1871.)

SIR,—I am directed to forward, for the consideration and orders of His Excellency the Governor General in Council, the accompanying copy of a letter from the Council of the Agricultural and Horticultural Society, dated the

20th December 1870, soliciting that the plot of land south of the fence, which bounds the grounds attached to Belvedere, and which is the property of Government, may be made over to the Society in perpetuity, and stating that in return the Society is willing to forego altogether the annual grant of Rs. 5,000 which it at present receives from Government.

2. The Lieutenant-Governor sees no objection to the proposal of the Society, and recommends that the transfer of the land may be allowed.

3. The only doubt that occurs to the Lieutenant-Governor as to the possibility of meeting the Society's wishes is, that it has been intended to erect on the ground in question barracks for the native infantry, but from inquiries made His Honor is led to hope that this will not be an insurmountable objection; and he desires me to add that, apart from a desire to promote the objects of so useful a Society, it will undoubtedly be a great advantage to the Lieutenant-Governor of Bengal to have a garden immediately to the south of Belvedere instead of native infantry barracks.

4. The Lieutenant-Governor has ascertained that, without any precise stipulation as to keeping the ground in an ornamental state, the Society will probably be quite willing to agree to certain conditions which will prevent the occupation of the ground by them becoming disadvantageous to the Lieutenant-Governor's residence. This point, however, will be settled between the local Government and the Society; and the connection of Belvedere with the concession is only referred to here in the hope that it will render the Governor General in Council not less willing to give a general consent to the arrangements proposed.

From A. O. Hume, Esq., C. B., Secretary to the Government of India, Department of Agriculture, Revenue, and Commerce, to the Officiating Secretary to the Government of Bengal, General Department,—(No. 61, dated Simla, the 28th July 1871.)

Sir,—In reply to your letter No. 124, dated 12th January last, I am directed to state that the Governor General in Council sanctions the proposal to make over to the Agricultural and Horticultural Society the plot of Government land south of the fence which bounds the grounds attached to Belvedere, in return for which the Society will forego altogether the annual grant of Rs. 5,000 which it at present receives from Government.

2. I am, however, to state that this sanction is given on the distinct condition that the occupation of the land for any other purpose than that of forming an agri-horticultural garden will not be allowed; and that should it ever cease to be used for this purpose, it will be at once resumed by Government.

From R. H. Wilson, Esq., Officiating Under-Secretary to the Government of Bengal, to the Secretary to the Agricultural and Horticultural Society of India, No. 2389, *dated Fort William, the 12th August* 1871.

Sir,—With reference to the letter from the Council of your Society, dated the 20th December 1870, soliciting that the plot of Government land south of the fence which bounds the grounds attached to Belvedere may be made over to the Society in perpetuity, for the purpose of laying out an experimental garden, I am directed to forward, for the information of the Council, a copy of the letters noted on the margin, from which it will be seen that His Excellency the Governor General in Council sanctions the transfer of the land as proposed, on the understanding that the Society will forego altogether the annual grant of Rs. 5,000, which it at present receives from the Government.

1. To the Secretary of the Government of India, Home Department, No. 124, dated the 12th January 1871.
2. From the Government of India, Department of Agriculture, Revenue, and Commerce, No. 61, dated the 28th July 1871.

2. The Lieutenant-Governor desires me to say that it will perhaps be convenient that possession of the land should be taken by the Society from the 1st of January 1872; in the meantime arrangements will be made for the preparation of a formal deed of conveyance transferring the property to the Society. The conditions specified in paragraph 4 of this office letter to the Government of India, and in paragraph 2 of the reply, will be embodied in the deed.

3. The necessary papers will be forwarded to the Solicitor to Government for this purpose, and that officer will be requested to place himself in communication with the Society on the subject.

From the Secretary Agricultural and Horticultural Society of India, to the Officiating Under Secretary to the Government of Bengal, Dated Metcalfe Hall, Calcutta, 21st August 1871.

I am directed by the Council of the Agricultural and Horticultural Society to acknowledge receipt of your letter, No. 2389 of the 12th Instant, with its two enclosures, and to convey the best acknowledgments of the Society for compliance with the request conveyed in my letter of 20th December last, for the transfer of the piece of ground South of Belvedere to the Society for the purposes of an experimental garden.

2. The Society, I am to add, accept the transfer of the ground from the 1st of January next, on the conditions specified in para 4 of your letter of 12th January, to the Government of India, No. 124; and in para 2 of the reply from that Government of 28th July 1871.

In connection with the above the Council gave the following notice of motion, for confirmation at the next meeting.

"That the Council of the Society be allowed to appropriate a sum not

exceeding Rs. 25,000, out of the invested capital of Rs. 42,700 from time to time as required for the erection of a suitable building on the ground lately acquired by the Society from Government; or for the purchase of any suitable dwelling house in the immediate vicinity of the said ground, for excavating tanks, and laying out such land so acquired for a garden for the use and benefit of the Members of the Society in the terms and conditions of Ch: V Sections I and II of the Bye-Laws."

PROPOSAL FOR AN AGRICULTURAL EXHIBITION IN 1873.

Read the following correspondence arising out of the Resolution passed at the Monthly General Meeting held in June last:—

From the Secretary to the Agricultural and Horticultural Society of India, to the Secretary to the Government of Bengal, dated Metcalfe Hall, 13th July, 1871.

SIR,—At the last monthly general Meeting of the Agricultural and Horticultural Society, held on the 15th June, the subject of Agricultural Exhibitions was discussed, in connection with certain interesting details that were then submitted regarding the last annual show of the Royal Agricultural Society of England; and a resolution was passed to the effect that a communication be addressed to the Government of Bengal.

2. It will be remembered that the first and, as yet, the only Exhibition of an agricultural character that has been held in Calcutta, under Government auspices, took place in January 1864.

3. It being important to know if any and what progress has been made in the different branches of agriculture during the last 7 years, and the facilities for sending specimens from various parts of the country having considerably increased in that time, I am directed by the Council respectfully to submit to H. H. the Lieutenant Governor, the desirability of holding another Exhibition in January 1873, on such plan of operation as His Honor may consider best, and to tender the aid of the Society in assisting to carry out the details of the scheme. The Council would, however, venture to suggest that prize lists should be previously prepared by a Committee specially appointed for the purpose, and that special encouragement should be held out to the rural classes for growing successfully articles which require special encouragement. The Council suggest that for the Exhibition in the early part of 1873, should His Honor approve of the proposal, the expences thereof might be included in the next budget. The Council further submit that the result of this Exhibition will probably prove of special value to the recently organized Department of Agriculture, as well as to all interested in the development of the agricultural resources of the Country.

From R. H. WILSON, ESQ., *Offg. Under-Secy. to the Govt. of Bengal, to the Secy. to the Agricultural and Horticultural Society of India, No.* 2195, *dated Fort William, the* 26*th July* 1871.

SIR,—I AM directed to acknowledge the receipt of your letter dated the 13th instant, suggesting that another agricultural exhibition be held in January 1873, and in reply to state that, before passing final orders on the proposal, the Lieutenant-Governor will be glad to be informed if the Society have reason to believe that practical benefits have resulted from the last exhibition in the way of the improvement of agriculture; and if so, I am to beg that you will be so good as to specify any that have come to the knowledge of the Society.

From the Secretary to the Agricultural and Horticultural Society of India, to the Secretary to the Government of Bengal, Dated Metcalfe Hall, 10*th August* 1871

SIR,—I am directed by the Council of the Agricultural and Horticultural Society to acknowledge the receipt of your letter, No. 2195 of the 26th ulto., and to offer the following observations.

2. The Council are of opinion that the exhibition of January 1864 had the desired effect of enlisting the interest of the native Zemindars, and of the community in general, in the objects which the exhibition was intended to promote.

3. One great practical effect of the exhibition was that it enabled the Government and the community to form a comparative idea of the growth of the different articles, and the breed of live stock in different parts of the country, and the consequent increased competition on the part of many to avail themselves of the improvement in the specimens exhibited by others. It is only by public exhibition that information as to the state of agriculture in the different parts of the country can be practically known, and the progress made accurately ascertained. It is improbable that all the benefits derivable from periodical exhibitions can be realized by such spasmodic, unsustained and interrupted efforts as were made in 1864-65.

4. This exhibition, it will be remembered, was followed in the succeeding year by local exhibitions in various districts of Bengal. These local exhibitions were more or less successful as a stimulus to those interested in agricultural pursuits, and thus, in their turn, subserved the object in view.

5. It was originally contemplated that another central exhibition should be held in Calcutta in a reasonable period after these local shows, in order to test what improvement in agriculture, the breeding and rearing of stock, in the manufacture and use of agricultural machinery and implements had taken place since the first central exhibition of 1864. Owing however to the famine in Orissa and subsequent distress in various parts of Bengal, any good effects which might have resulted from the institution of these exhibitions have been arrested in the hard struggle for life during the period

referred to; and for these reasons the Council of the Society are not in a position to state what specific advantages actually have accrued.

6.—As regards machinery however I am directed to bring to the notice of His Honor the Lieutenant Governor the opinion of one of the largest exhibitors of machinery at the exhibition of January 1864, which is couched in the following terms:—"If such exhibition as that held at Allipore in 1864 had been steadily continued it is our firm conviction the results would have shown themselves ere this."

7.—It could scarcely be expected, even by the most sanguine, that a single initiatory central exhibition, followed by a few local shows in the succeeding year, would produce any perceptible lasting benefits. In support of this view the Council would draw attention to the case of agricultural exhibitions in England where it has required a succession of annual shows to achieve some of the objects contemplated by the promoters.

8.—It is a question whether at the present day the Royal Agricultural Society could point out such an extent of improvement in the various departments of agriculture as might have been anticipated after the experience and encouragement of more than a quarter of a century.

9.—If, therefore, backed by the great intelligence, skill, and capital of a large section of the community, the state of agriculture in England leaves still great room for improvement, it is but fair to assume that, before any perceptible improvement can be looked for in the agriculture of Bengal, persevering and well sustained efforts for its improvement must be made by the employment of means successfully availed of in England by district and central exhibitions of agricultural produce, stock, machinery, and implements.

From the Officiating Secretary to the Government of Bengal, in the Judicial and Political Department, to the Secretary to the Agricultural and Horticultural Society, No. 597, Dated Yacht Rhotas, Gowhatty, the 27th August 1871.

SIR,—I am directed to acknowledge the receipt of your letter dated the 10th instant, communicating the opinion of the Society in regard to the benefits which have resulted from the Agricultural Exhibition of 1864, in the way of improvement of agriculture, and with reference to your previous communication of the 13th ultimo, I am to state for the information of the Society that, with the Census and Cess work in hand, the Lieutenant Governor is not prepared to pledge himself to an early Agricultural Exhibition. His Honor is of opinion that without holding the proposed Exhibition, the agricultural interests of the country may perhaps be improved in a humbler manner meanwhile.

TRANSMISSION FROM ENGLAND TO INDIA OF TIMBER TREES AND FLOWERING SHRUBS, HERMETICALLY SEALED, BY PATTERN POST.

Read the following letter, with its accompanying endorsement and annexure in reference to the papers submitted at the last monthly meeting :—

From C. BERNARD, ESQ., *Officiating Secretary to the Government of Bengal, in the Revenue Department, to the Secretary to the Agricultural and Horticultural Society, No.* 3373, *dated Fort William, the 5th September* 1871.

SIR,—With reference to your letter dated the 19th July, I am directed to forward herewith the accompanying endrosement* and annexure, from the Government of India in the Department of Agriculture, Revenue and Commerce, containing a letter from the Officiating Director General of the Post Offices in India, from which it will be seen that an attempt has been made to secure the transmission by Pattern Post of timber trees, and flowering shrubs between England and India.

* No. 107 dated 25th August.

From F. R. HOGG, ESQ., *Officiating Director General of the Post Offices of India, to the Secretary to the Government of India, Department of Agriculture, Revenue, and Commerce, No.* 2078, *dated Simla,* 14*th August* 1781.

SIR,—I have the honor to acknowledge the receipt of your letter, No. 75, dated 9th August, relative to the transmission of timber trees and flowering shrubs between England and India by Pattern Post, and in reply to offer the following remarks.

2.—The Post Master of Bombay is right in stating that, under the conditions laid down by the British Post Office, which compel the packing of samples in such a manner as to be easy of examination, hermetically sealed tin cases cannot be received for transmission to the United Kingdom by Pattern Post. These conditions will be found in pages 12 and 13 British Postal Guide, dated 1st April 1871.

3.—Notwithstanding the remonstrances of the Post Office in this country, Her Majesty's Post Master General has recently determined to restrict the Pattern Post between England and India to *bona fide* samples, and it has not therefore been without surprise that I have demi officially obtained copy of a despatch from Her Majesty's Secretary of State for India, No. 19, dated 9th March 1871, stating that liberal concessions had been granted by Her Majesty's Post Master General in respect to the transmission by Pattern Post between England and India of plants in air tight cases to a maximum weight of 8 pounds, and of seeds completely closed so as to be free from interference.

4.—I have placed myself in communication with the London Post Office

on the subject, and will acquaint you with the result of my reference.

No. 107.

Copy forwarded to the Government of Bengal for information, with reference to its endorsement No. 2802 dated 27th ultimo, and with an intimation that a further communication will be made on the subject hereafter.

DEPT. OF AGRI., REV., AND COMMERCE; *Agriculture & Horticulture, Simlâ, 25th August,* 1871.	By Order. (Sd.) J. GEOGHEGAN. *Under Secretary to the Government of India.*

MISCELLANEOUS COMMUNICATIONS.

1. From Government of Bengal;—reports on experimental trials with Compton's patent chemical manure.

2. From Government of India, department of Agriculture and Commerce; applying for two complete sets of the publications of the Society from the beginning, and to be furnished with all future publications.

The Secretary said he had forwarded copies of the Transactions (old series), and of the Journal (new series); but was unable to supply the old series of the Journal in consequence of so many copies being out of print; whereupon it was resolved to request Members to send in any copies of the old series that may no longer be required by them.

3. From the same, forwarding extract of their proceedings in reference to the steps recently taken to acquire full information as to the present state and prospects and past history of the Indian silk trade, in view to ascertaining the best practical method of developing it, and improving Sericulture in India.

4. From John Scott Esq., returning thanks for a set (imperfect) of the publications of the Society, which will prove of high value to him as a book of reference in the works on which he is engaged.

Mr. Mowbray submitted a plant of Phulœnopsis————?, in flower.

For the above contributions and communications the best thanks of the Society were accorded.

Thursday, the 23rd November, 1871.

William Stalkartt, Esq., V. P., *in the Chair.*

The Proceedings of the September Meeting were read and confirmed.

The following gentlemen were elected Members:

Messrs. A. F. Wilkinson, W. J. Greenwood, D. W. Ritchie, C. F. F. DeHoxar, J. Blanchett, Capt. W. Barron, Major A. F. Corbett, Dr. H. A. Kidd; Manager, Government Garden, Fyzabad, and the Deputy Commissioner of Bassim.

The names of the following gentlemen were submitted as candidates for election:

W. Llewhellin Esq., Durbungah,—proposed by Mr. H. W. Stevens, seconded by the Secretary.

Mr. G. L. Narsing Row, Vizagapatam,—proposed by the Secretary, seconded by Mr. S. H. Robinson.

Maharajah Bhugeruttee Mohendra Bahadoor of Killoh Dewkonull,—proposed by Mr. T. E. Ravenshaw, seconded by the Secretary.

The Manager of Tarrapore Tea Garden, Cachar,—proposed by Mr. H. H. Sutherland, seconded by the Secretary.

The Rajah of Runtil, Mirzapore district,—proposed by the Secretary, Municipal Committee, Mirzapore, seconded by the President.

Lieut. R. Hunter, Madras Army,—proposed by Capt. J. Johnstone, seconded by the Secretary.

Percy Wigram, Esq, C. S., Bustee, N. W. P.,—proposed by Capt. C. S. Noble, seconded by the Secretary.

A. G. Tytler, Esq., Sub-deputy Opium Agent of Allygunge, Sewan,—proposed by Mr. Lewis Cosserat, seconded by the Secretary.

Capt. V. Guavain, Commander of the Steamer *Meinam,*—proposed by Mr. R. Blechynden, seconded by Mr. R. M. Daly.

Major W. M. Lees, Under-Secretary, Government of India, Military Department,—proposed by the Hon'ble E. Jackson, seconded by the Secretary,

E. L. Edgar, Esq., Tea Planter, Cachar,—proposed by Mr. W. H. Cogswell, seconded by Mr. J. H. Haworth.

Syed Welayet Ali Khan, Patna,—proposed by the Hon'ble W. Ainslie, seconded by the Secretary.

The following contributions were announced:

1. Report on the Royal Gardens at Kew for 1870. From Dr. Hooker.

2. Forest Culture in its relation to industrial pursuits, by Baron F. Von Mueller. From the Author.

3. Journal of the Asiatic Society of Bengal, Part 1, No. 2, and Part 2, No. 3, 1871. From the Society.

4. A quantity of Manilla Tobacco seed. From Dr. Hooker.

5. Seed of the Moreton Bay Chesnut, (*Castanospermum Australe*). From H. Leeds, Esq.

6. A large supply of seed of *Poinciana regia*. From Rajah Suttyanund Ghosal.

(The above seeds are available to Members.)

7. A small assortment of flower seeds of annuals, raised at Nynee Tal, and cuttings of Fuchsias and Geraniums. From F. E. G. Mathews, Esq.

8. A sample of Tobacco raised from French seed. From Colonel J. C. Haughton. (Referred to the Committee for report).

The Secretary announced the receipt, since the last Meeting, of several more complaints from Members regarding this year's importation of vegetable and flower seeds. He had, fortunately, been able to secure small consignments of vegetable seeds imported by recent steamers, from England and France, which he had distributed to all complainants. The Council had issued instructions that, with the view of preventing exposure to damp, each Member's share of next year's consignments be secured in hermetically sealed boxes previous to despatch. The importations from America and France will probably reach this in all August next.

Disposal of Motion.

The motion, of which notice was given by the Council at the last Meeting, to the following effect, was next brought forward:

"That the Council of the Society be allowed to appropriate a sum not exceeding Rs. 25,000 out of the invested capital of Rs. 42,700, from time to time, as required for the erection of a suitable building on the ground lately acquired by the Society from Government, or for the purchase of any suitable dwelling house in the immediate vicinity of the said ground, and also for excavating tanks, and laying out such land so acquired for a garden for the use and benefit of the Members of the Society, in the terms and conditions of Chapter V. Sections I. and II. of the Bye-Laws."

Proposed by Baboo Peary Chand Mittra, seconded by Mr. S. H. Robinson, and resolved that the above be confirmed.

Horticultural Notes.

Mr. F. E. G. Mathews, of Nynee Tal, advising the despatch of some plant cuttings, intimates the mode he has adopted for their preservation in a note, of which the following is an extract:

"I have this day despatched per pattern post, pre-paid, cuttings of various fuchsias and of geraniums. The weather is still warm for the time of year, and I am afraid some of the cuttings (fuchsias particularly) will not reach you in good order; however kindly let me know results. I have smeared

cuttings of two batches of fuchsias in collodion and the others with common melted wax. I have not much faith in collodion, as I find it *shrivels* up cuttings, the spirit, perhaps, in it produces this effect. I think common mucilage of gum Arabic or treacle, or honey, or syrup better. I will send you cuttings smeared with some of these substances for experiment. I will not send more till I hear from you as to fate of these. The damp moss ought to keep them fresh for two or three days, and they ought to be with you in five days altogether."

The Secretary mentioned he had lost no time in transferring these cuttings to Mr. Scott, Curator of the Royal Botanic Gardens, who had favored him with the following report:

"I duly unpacked the bundle of experimental cuttings from Mr. Mathews, and found all in a very similar and fair condition. The *object* of collodionising and waxing cuttings however was frustrated in this experiment by the three samples (the *clean cuttings, the collodionised, and waxed*) having been similarly enveloped in a thick layer of moist moss, so that the merits of *collodionising* was not in the least illustrated. After simply treating the cuttings with collodion, &c., there should be no need of moss (in such comparatively short journeys at least) or indeed anything else, than a couple of folds or so of thin cloth to wrap the cuttings in and tying the bundle at either end, in accordance with sample post rules. It is in respect to these that one of the great advantages of collodionising is illustrated; inasmuch as enabling us to despatch three or four times the number of cuttings at the same cost of those enveloped in the heavy covering of moist moss. For long journeys of two weeks or a month, I should recommend that they be simply collodionised (for I have yet much faith in collodion), and then placed in a light deal-wood case, amongst perfectly dry powdered charcoal: thus treated and with properly matured cuttings, I have every hope of successfully importing from Europe many a delicate plant, which it has been difficult to transmit even by Wardian cases. Mr. Mathews considers "the common mucilage of gum Arabic, treacle, or honey, or syrup better," and he is partly right if his view is simply that of sustaining the vitality of the cuttings. The three last named substances however are objectionable on account of *weight*, each requiring a quantity sufficient for the immersion of the cuttings. Gum Arabic has not this objection, and indeed answers the purpose well, though certainly *not better than*, or even as well as, collodion; that having considerably higher powers of adhesion.

Mr. Scott also offers the following remarks in reference to Dr. Beaumont's observations, which were submitted at the last meeting, regarding the too delicate treatment of *Clianthus Dampieri:*

"I have read Dr. Beaumont's letter. I think he is quite right about the mischief done by coddling the *Clianthus*; it augurs well to be one of our

gayest border annuals in the cold season. No better illustration is required than the magnificent plant exhibited at your last exhibition. Seeds sown in our flower beds about this time (early part of October) in a somewhat raised and sandy compost should do well."

TRANSMISSION FROM ENGLAND TO INDIA OF TIMBER TREES AND FLOWERING SHRUBS, HERMETICALLY SEALED, BY PATTERN POST.

Read the following letter from the Superintendent, Botanical Gardens, N. W. P., to the Government, N. W. P., in reference to previous correspondence on the same subject introduced in the Proceedings of the last meeting. Dr. Jameson's letter, which is dated from Saharunpore, 4th October, is forwarded to the Society by the Government of Bengal:

"I have the honor to acknowledge the receipt of your docket, No. 1408 of 6th ultimo, enclosing correspondence regarding the three hermetically sealed cases of plants received from Dr. Forbes Watson, by pattern post, on 29th March last.

"In the three cases there were 392 small plants packed in goat's (?) hair perfectly dry, all the earth having been removed from the roots of the plants. All the plants were well rooted. To each plant parchment labels were attached, nearly all of which were either destroyed or illegible, caused by the moisture from the plants. No invoice was received with the cases. The plants identified were Oak, (Quercus robur); Ailantus excelsa, Black Poplar, (Populus nigra); Willow, (Salix); Purple Beech, (Fagus purpurea); Maiden Hair Tree, (Salisburia adiantifolia); yew, (Taxus baccata); Barbary (Barberis.) Several kinds of Pine, Fortune's Holly, (Ilex Fortunianum); common Holly, (Ilex aquifolium); Maple, (Acer); Plane, (Platanus Orientalis.)

"But many of the stems of the plants were so thin as to render their chance of succeeding, when the cases were opened, an impossibility, as the season had so far advanced. Had the cases been forwarded in December, a great number of the plants would have succeeded. I have already brought to the attention of Dr. Forbes Watson, on the experiment being again repeated, that the cases ought not to leave England later than the 1st January; that the thickness of the stems of the plants packed ought not to be less than 2-8ths of an inch; that lead or zinc Nos. should be attached to each plant to correspond to the invoice, which ought to be forwarded by the Overland Mail."

MISCELLANEOUS COMMUNICATIONS.

The following letters were also submitted:

1. From A. Grote, Esq., in reference to the insects received from Mr. Buck, of Futtegurh, as destructive to mustard and wheat crops, submitted at the June Meeting. Mr. Grote writes, "yours of 7th July and 11th August

received, as well as the parcel, the insect contents of which I at once made over to Mr. Moore of the India Museum, while I despatched the cotton wrapper to Major Clarke. Your insects prove to be harmless ladybirds' Coccinella, seven punctata, in the mature and larval conditions. The bottle labelled "Mahun" which you call the mustard-destroyer, contained larvæ only; the bottle labelled as having been so plentiful on wheat, contained mature beetles, as well as larvæ. These Coccinellidæ feed both as larvæ and perfect beetles entirely on aphides or plant-lice which are roughly speaking synonymous with blight. The ryots should delight in seeing them rather than look on them as enemies, though in so far as they betray the presence of blight, they are, of course unpleasant visitors. It must have been the preponderance of aphis that injured the Futteghurh sursoo crops."

2. From Baboo Peary Mohun Banerjee, of Allahabad, sending a "Mukoe" plant, with reference to the allusion to this plant in Lieut. Pogson's communication regarding Sarsaparilla, submitted at the August Meeting. Mr. Pogson remarks, "that this plant is called "Sarsaparilla" in Shakespeare's Dictionary. Baboo Peary Mohun Banerjee writes that this plant is extensively used by native physicians; the fruit is said to possess good medicinal qualities, but the extract is prepared by putting the entire shrub and water together and distilling off, that water is used to a very large extent by the Hakeems. It is called Infusion *Mukoe*. The tree grows up to three or four feet. It is a common weed and does not require any culture."

The specimen in question is recognised by Mr. Scott as *Solanum rubrum*, a widely diffused Indian weed. "It is largely used for some medicinal purposes by the Hindoostanees in Bengal, and for this purpose the juice is expressed from the green plant: it is the Goorkhee of the natives of Bengal. In the Mauritius, according to Roxburgh, it is used as a pot herb; and a poor one I guarantee it to be. The fruit may be edible, and appease hunger-cravings, but, the attempt to live upon it, assuredly will be, but a sinking unto death. The fruit is called *Mako* by the Hindoostanees; the plant "Kachmach" or "Riungi." The application of the term Sarsaparilla to it is singular, the two plants having neither morphological nor officinal community. The roots of another species--the *Solanum Jacquini*—(the *Kantikaree* of the natives) however, when beaten up and mixed with wine, are given to check vomiting, the juice of the berry is also administered as a gargle, in cases of sore-throat, and also as an expectorant in coughs and asthma. A closely allied-indeed, scarcely distinct species—*S. nigrum*—has the following medical properties ascribed to it:—A grain or two of the dried leaf have sometimes been given to promote various secretions, possibly by exciting a great and rather dangerous agitation in the viscera. It is a narcotic, and according to Orfila, its extract possesses nearly the same power as Lettuce opium. In Brazil it is called

Carachichu or *Erva Moira*, and when bruised is applied either in poultices or baths to painful wounds, and in generally inflammatory cases with a predominant excitement of the nervous system.—*Lindley's Flora Medica.*

3. From Baron Von Mueller, Director, Royal Botanic Garden, Melbourne, acknowledging receipt of bamboo seed and expressing his readiness to interchange, and to receive the publications of the Society.

4. From the Under Secretary, Government, N. W. P., forwarding the results of further trials with the American James River Virginia tobacco seed in certain districts.

5. From the Secretary, Government of Bengal, requesting that in future two copies of the 40 hitherto supplied to them of the Journal of the Society be transferred to the Department of Agriculture, Revenue, and Commerce.

6. From the Secretary, Government of India, Department of Agriculture, Revenue, and Commerce, conveying thanks for certain copies of the publications of the Society.

7. From John Scott, Esq., returning thanks for his election as a Honorary Member of the Society.

Dr. Tonnerre informed the Meeting that he had taken advantage of a recent visit to Ceylon, to inspect the Royal Botanic Garden at Peradinea, and that Mr. Thwaytes, the Superintendent, had kindly intimated to him his readiness to assist the Society in stocking its new garden with all available plants in his possession in duplicates and triplicates. The best thanks of the Society were tendered to Mr. Thwaytes for his obliging offer, which will be shortly availed of.

Mr. Lynam submitted for inspection two fine healthy specimens of handsome foliage plants, *viz.*, *Peperomia marmorata* and *Sanchezia spectabilis*, which had been recently imported. Mr. C. E. Price shewed a well-flowered plant of *Limatodis rosea.*

Thursday, the 21st December, 1871.

J. A. CRAWFORD, ESQ., *President, in the Chair.*

THE Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:

Messrs. W. Llewhellin, G. D. Narsing Row, Percy Wigram, A. G. Tytler, E. L. Edgar, Maharajah Bhugeruttee Mohendra Bahadoor, the Manager of Tarrapore Tea Garden, the Rajah of Runtil, Lieut. R. Hunter. Capt. V. Guavain, Major W. M. Lees, and Syed Welayet Ali Khan.

The names of the following gentlemen were submitted as candidates for election:

Lionel Ingels, Esq., Manager, Namdung Estate, Seebsagur, Upper Assam, —proposed by Capt. W. G. Maitland, seconded by the Secretary.

The Maharajah of Cashmere,—proposed by the President, seconded by Baboo P. C. Mittra.

A. Hotson, Esq., Merchant, Rangoon,—proposed by Mr. H. Krauss, seconded by the Secretary.

Col. J. T. Shakespear,—proposed by the President, seconded by Baboo P. C. Mittra.

Capt. A. Cunningham Dando, R. N. R.,—proposed by Mr. S. H. Robinson, seconded by Dr. Tonnerre.

Lieut. Davison, 15th Hussars,—proposed by Dr. T. Beaumont, seconded by the Secretary.

The following contributions were announced:

1. The Annals of Indian Administration for 1868-69 and 1869-70, Part 2, Vol. XIV., and Part 1, Vol. XV. From the Government of Bengal.

2. Records of the Geological Survey of India, Vol. 4, Part 4. From the Superintendent.

3. A further supply of acclimatized flower seeds from Nynee Tal. From T. E. G. Mathews, Esq.

4. A quantity of tubers of *Gloriosa superba*. From Colonel C. S. Ryder.

5. A large supply (lbs. 20) of Deodar seed. From Dr. Wm. Jameson.

6. Specimen of a vegetable substance found occasionally in the Neilgherry Hills. From Oswin Whynton, Esq. Mr. Whynton states "that this substance is found at an elevation of 5,000 feet. The natives call it 'little man's bread' in allusion to the tradition that the Neilgherries were once peopled by a race of dwarfs. Should I be fortunate to procure a quantity, I will forward it to the Society. Meantime, I shall esteem it a favor if you can tell me what the article is; it is found on the surface and has at least, apparently, neither stem nor root."

The Secretary read the following remarks by Mr. John Scott on the above substance:

"The specimens sent from Coonoor under the name of *"little man's bread"* are the dried tubers of a salep-yielding orchid: the entire tuber being incrusted with an opegraphic lichen, while the other which is cut and paired, is, as you remark, something like the '*salep misree.*' Both are evidently, however, of the same species and very probably, one or other of the Neilgherry *Eulophias.* Though the colour of these specimens is much less pure than the salep misree of the bazaars, they seem none the less rich in bassorin, so that extremely hard and horny though they are, portions of them immersed in boiling water, readily swell up and acquire a gelatinous character. The specimens sent by Mr. Whynton must (judging by their hard and bony texture and lichens

coverings) have been dead for years, and it would be well to suggest to him, that in his future promised hunts for the 'little man's bread' he also sends fresh pseudo-bulbs or tubers of the terrestrial orchids which may then occur: this may enable us to determine the species which yields the 'little man's bread.'"

7. Sample of raw fibre from Sylhet, forwarded by the Officiating Collector.

Mr. Sutherland thus writes regarding this fibre:

I have the honor to forward herewith for examination by your Society some specimen of the fibre sent by Mr. W. Foley, who remarks thus: "The fibre which I sent over some time ago was obtained from a plant called in the vernacular "oolta kamal;" it is found all over Bengal. I saw the plant in Rungpore, when I was in that district some years ago. It thrives on teelahs and high flat lands and is propagated by seed which ought to be put down by the end of February or the early part of March. In good virgin soil, the plants will attain the height of 9 or 10 feet within the first year. The great advantage of this "oolta kamal" is that it is a perennial and when cut down (which should be done about a foot from the ground) it throws out a number of shoots; the stalks are treated precisely the same way as jute stalks. I believe a second crop may be obtained during the year. I tried the experiment on a small scale and I obtained only few seeds and that late in the season. I have now a quantity of seed and will try the experiment on a large scale and will furnish you with further particulars.

The fibre in question is the produce of *Abroma augusta.* Mr. Hutchinson of Messrs. Toulmin & Co., considers it good, and is of opinion that it might be used with advantage by rope-makers for mixing with Manilla hemp;—value £35 per ton.

Mr. John Martin submitted some apples in an excellent state of preservation with the following note:

"I have the pleasure to forward for the inspection of the Members of the Horticultural Society some English apples (Ribstone Pippins) picked by me from a tree in my garden in Devonshire, in the middle of September last. When picked they were tolerably ripe. I had them carefully rolled in tissue paper and, with some soft clothing, put in the bag in which I now send them. They were sent Overland *via* Southampton, and arrived in India on the 22nd October. As you will see they are still in excellent preservation, though they have already been two months in this country. Judging by my success with these apples, I have no doubt, with ordinary care, many fine kinds might be brought to India."

Horticultural Notes.

Submitted the following extracts of letters from Mr. S. Jennings of Allahabad:

15*th December*.—"I have just received an excellent batch of cuttings from England, packed in moss, by sample post. Nearly the whole were fresh and green, and I entertain the strongest hopes of saving 10 out of 15, a very good proportion I think. They were planted in a mixture of sand and leaf-mould, under a glass frame, and consist of the following, all. of which I believe are new to the country and will be great acquisitions. They are *Crotons*,—Johannis, multicolor, undulatum, maximum, interruptum, irregulare, and Vietchii. *Dracœnas*,—Gulfoylei, Regina, Macleayi, Mooreana and magnifica, *Ixoras*—Colei, Dixiana and crocata futilans."

19*th December*.—"Advising despatch of a further collection of bulbs and a box of roses, a well known Nurseryman in London, gives the following instructions. I send them to you for general information, if you think them of sufficient interest.

"*Achimenes*, *Gesnerias* and *Gloxinias*—Shake out the material at once and re-pot in a mixed light sandy soil, just covering the roots, that is to say, about ½ an inch of soil over them, and place them in a bath-room where there is plenty of warmth, and keep up a moist atmosphere by frequent syringing of the walls and throwing water about the floor for a few days; then syringe them slightly at first, still keeping up the moist atmosphere around them, and as the foliage developes itself, you will increase the quantity of moisture. They prefer shady situations for growing in.

"*Caladiums* will require the same treatment, except that the crown of the bulb must stand above the soil, and they must not have any water on them till they show symptoms of growth. This will be induced by the damp atmosphere and the warmth of the room. Immediately they commence developing their leaves, give water moderately, and ultimately stand them in pans of water, or plant them out in marshy situations, or places where they will get plenty of irrigation.

"*Amaryllis* including *Valotta purpurea*—Plant out or shift into 7-inch pots, and let them have the bath-room for a little time just to excite growth; you may then put them where you please.

"*Curcumas*—Treat much as you would *Caladia*.

Begonias.—Let them remain in the pots they are sent in, being established there, when they commence growing, shift them into pots a size larger, and when in full growth, they take water freely.

"*Eucharis*—Shift this at once into a larger pot. Give it a few days in the bath-room, in a damp atmosphere, after that give it abundance of water and warmth. If you have a pond, you may plant it in the margin, where it will be flooded occasionally. It delights in moisture and is a native of the Brazils where heat and moisture prevail. *Imantophyllum* will do very well where the *Eucharis* does.

"*Cyclamen persicum*—If you plant them out, be sure that you put a considerable amount of rubble, brickbats, any thing in that way, either incorporated with the soil or what is better a foot or eighteen inches under the bulbs, and about a foot of soil above the rubble. Three things *Cyclamen* dislike, 1*st*, too much moisture at the root; 2*nd*, too much exposure to the sun, and 3*rd*, cold winds. How hot winds will affect the plants will depend upon their being in leaf or dormant at the time.

"Lilies prefer a moderately stiff soil, and like growing where there is a little shade. They must not have any manure except in a clear liquid form when they are in growth, and you may give as much as you like then. The plant likes it, but it is death to the bulb to have any gross manure about it. Grow lilies either in pots or plant them out. If the latter, let them have shade at the roots and attend to them with moisture in dry weather.

"The *Clivia* will take the same treatment as Imantophyllum.

"*Gloriosa*—The same as Achimenes.

As to the roses, 1*st*, when the case reaches you, place it in a dark room and unscrew the lid. The second day let a very little air in. The third day remove the lid. The fourth day unpack the roses, then pot them at once, and place them in a bath-room, syringing the sides of the room to give a damp atmoshere, but give no water at the roots for say a week. Twice a day syringe the roses just to moisten the wood, and at the end of the week give just a little water at the roots, and as the plants show symptoms of growing, increase the water. When out of all danger, and you know that they are alive, gradually accustom them to the air then cut back to within three or four eyes of where they were pruned last."

The only point upon which I have doubts is the advisability of planting out *Achimenes*, *Gloxinias*, and *Caladia* when received instead of keeping them dry till March and April; the rest is good useful advice.

MISCELLANEOUS COMMUNICATIONS.

Letters were submitted from Lieut. J. F. Pogson, suggesting the introduction into Upper India of the gigantic yam of British Burmah. The following is extract of Mr. Pogson's letter:

"I may here mention, that the "*Climax*," potatos, were very superior, and as two gentlemen in this station have now a supply of them for next year's sowing, this valuable variety will soon be established.

"The potato disease has apparently extended to all potatos raised in Simla. Those sent for sale to this station, are very fine to look at, and of large size, but when boiled they are yellow and waxy, and have a peculiar smell. The best in the market are small potatos, and of these one-half show signs of disease.

"When the entire stock of this diseased potato dies out, there will be some chance of better varieties being introduced by the authorities, in the meantime however, I think it would be advisable for the public good if some other vegetable was introduced for general consumption. Colonel Brown, the Deputy Commissioner of the Mergui District, British Burmah, has recently submitted his Report on the "Selons," and states that this peculiar race of people, spear fish and wild pigs, which constitute their principal articles of food. Turtles and shell-fish also afford them subsistence, together with yams, which grow on the islands, and are sometimes found of thirty pounds weight.

"If this splendid yam was introduced into Bengal, the N. W. Provinces, Oude, and the Punjaub, we should have something to fall back upon, when potatos are not procurable; and it is just possible that the natives will eat boiled and rosted yams, if they can get them at the same price as rice, or inferior flour.

"The constant recurrence of famine shows that something should be done to meet the evil, and about the simplest plan would be the formation of plantain plantations, in the vicinity of villages, far removed from high roads and railways. The yam planted near a plantain, will come to perfection, even if the fall of rain is slight, and with these two additions, to the ordinary stock of food, the advent of a drought need not be looked upon as a dire calamity, which can only be met by appealing to the European public, for charitable subscriptions.

"There are few villages in India, so highly cultivated, as to have no officially recognised waste, or unculturable land, and as such land will answer for plantain cultivation, official sanction to grow it free of cost, (or revenue) is all that is needed to start the project; of course where the plantain is unknown, the authorities will have to supply young plants.

"I feel certain that if the Government was once convinced of the great value of the plantain as a producer of food, that it would offer inducements to the ryots and zemindars of districts more or less liable to famine, to grow plantain by the acre as regular crop. We are told by Baron Humboldt that "the same space of a thousand square feet, which will yield only 462 lbs. of potatos, or 38 lbs. of wheat, will produce 4,000 lbs. of bananas, and in a shorter period of time."

"The unripe fruit is sometimes used as bread; it is dried in the oven, and in this state is eaten in the manner of bread. When thus dried, it may be kept for a long time without spoiling, and is usually carried with them in this dry state, by the natives when they are proceeding on a long journey."—(*Vide Chemistry of Common Life, Professor Johnston*, pp. 109 *to* 111.)

"In tropical America, about 6½ lbs. of the fruit, or 2 lbs. of the dry meal, with ½ lb. of salt meat or fish, form the daily allowance for a labourer, whether slave or free.

The plantains of Martaban and Burmah are famous for their size and flavor, and very good descriptions exist all over Bengal Proper, so there can be no difficulty about obtaining young plants and suckers; and if the experiment of planting them was tried in the District of Sirsa, where famine is now raging, (*vide* Mr. Deputy Commissioner R. G. Melvill's letter) the starving poor would have the satisfaction of knowing that they have seen their last famine."

It was agreed that Col. Brown be addressed on the subject.

From the same on the subject of the Muko and Mukoe plants, with reference to previous correspondence.

"I have noticed "observes Mr. Pogson" the remarks on the subject of the *Mukoe.* (Sarsaparilla) which appears in the Society's Proceedings of 23rd November last. The "*Muko*" of Shakespear's Dictionary is distinct from the "*Mukoe*" of the same work. *Muko* means name of a species of Solanum (Nigrum). The word *Mukoe* is Sarsaparilla,—*vide* Dictionary. This latter plant has a leaf very like the "Zizyphus Jujuba." There is lots of it in the jungle at the foot of the hills, and its fruit is by no means bad, being somewhat like a small "*Bair,*" size that of a large marrow-fat pea; colour deep purple like the "*Jaumun.*" I believe the kernel of the seed is edible. I will secure samples if I go to the Sewallicks."

From the Secretary, Agricultural and Horticultural Society, Lahore, returning thanks for the last published Number of the Journal, Vol. 3, part 1.

From the Secretary, Agricultural and Horticultural Society, Madras, to the same effect.

From T. Sandys, Esq., a printed notice of the mode of working a machine which he has invented for removing the bark from the stem of the Rheea plant.

From Dr. Bonavia, Secretary, Agricultural and Horticultural Society, Lucknow, promising to send grafts of certain fruit trees and rose plants for the new garden.

Mr. John Lynam submitted a plant of *Dieffenbachia Wierii* and a new *Caladium,*—Meyerbeer.

Mr. Archibald Rogers submitted *Cyclamen Persicum* in bud; root received from England in 1869.

Five marks were awarded to Mr. Lynam for each of the two plants, (*Peperomia marmorata* and *Sanchezia spectabilis*) brought before the last Meeting; for the care taken of them since he received them from the Botanic Garden. Had these plants been imported by Mr. Lynam they would be deserving of 10 marks each.

A. H. BLECHYNDEN,
Secretary.

REPORT

OF THE

Agricultural and Horticultural Society

OF

INDIA.

Report from the Council of the Society at the General Meeting of the 18*th January*, 1872.

The time has again arrived when the Council are expected to furnish the usual exposition of the affairs of the Society.

To commence with more immediate concerns, the Executive have the pleasure to announce that the number of new names (133) added to the list during 1871, very nearly equals that of last year, and is above the usual average. It is gratifying to note again that there has been an equally large accession of Members (16) from the native community as in 1870.

The following tabular statement* affords the details more fully in comparison with foregoing periods, while at the same time it represents an analysis of the constitution of the Society.

The lapses alluded to in the last column comprise 14 deaths† (a smaller average than usual); 51 resignations (a full proportion), and 89 removals from the list. This last number very much exceeds any previous record; and it is therefore necessary

* For tabular Statement, see next page.

† Messrs. C. Ducas, G. Smeaton, J. White Smith, G. G. Mercer, A. D. Dunne, J. M. G. Cheke, Major J. T. Tovey, Major C. M. McMullin, Dr. Bedford Allen, Major-General A. Broome, Colonel John Colvin, the Hon'ble J. P. Norman, Captain W. S. Millard, and Dr. J. Fawcus.

CLASSIFICATION.	In 40 previous years.	In 1861.	In 1862.	In 1863.	In 1864.	In 1865.	In 1866.	In 1867.	In 1868.	In 1869.	In 1870.	In 1871.	Gross Total.	Total real number at the close of 1871 after deducting lapses.
Honorary Members	18	0	0	0	0	0	0	0	2	0	0	2	22	10
Associate Members	4	0	0	0	0	0	1	0	0	0	1	0	6	2
Corresponding Members ...	5	1	0	0	2	0	0	1	1	1	3	0	14	10
Civilians	500	22	13	12	18	30	18	16	17	22	25	24	717	195
Merchants and Traders ...	430	17	19	24	17	22	11	21	13	8	24	14	620	130
Indigo and other tropical agriculturists	360	15	21	20	20	41	28	24	16	17	34	22	618	157
Military Officers	444	26	25	10	21	31	9	19	20	14	20	34	673	129
Medical Officers	169	6	7	5	7	14	5	7	6	6	5	8	237	49
Asiatics	183	8	3	7	9	8	9	7	8	9	16	16	283	75
Clergy	27	0	0	2	0	3	3	1	0	3	0	0	39	7
Law Officers	81	2	4	2	3	4	8	4	4	3	6	4	125	32
Miscellaneous	50	0	12	9	3	10	6	16	4	11	6	9	146	51
	2,263	97	104	91	100	163	108	116	91	94	140	133	3,500	847

N. B.—Of these 847 Members, 168 are resident in Calcutta, 563 in the country, and 116 in Europe.

to mention that in addition to the number (27) who come under Section 6 of Chapter III. of the Bye-Laws,—*viz.*, four years absence from India, the names of 61 have been withdrawn partly for non-payment of subscriptions and partly for not responding to the call to rejoin on their return to India: a large proportion of these, 61, have not contributed to the funds of the Society for the last three or four years. The fact that no names were withdrawn in 1870, on either of the above accounts, has necessarily much increased the number for the last year.

Of the total real number (847), at the close of 1871, after deducting the above-mentioned deaths, resignations, &c., 33 are life members, 22 are honorary, associate, and corresponding, and 77 are absent from India,—leaving 715 as the actual number of paying members on the list, or nine more than last year.

The Council have again to congratulate members on the continued financial prosperity of the Society. The total amount of receipt for the past year, it will be seen, is in excess of the previous year by Rs. 1,033-14-10. Such excess has not arisen from any extraneous items, or from the admission of "life members" as in previous years; and therefore the excess cannot but be looked upon as most satisfactory. It would have been still more so had not the Society to contend against the difficulties and loss sustained by large quantities of imported vegetable and flower seeds having been rendered useless by long and continuous rain destroying their vitality, thereby rendering it necessary to have them thrown away instead of being sold as so much "surplus stock," and proceeds brought to credit. While on this subject, it may not be out of place to mention that in ordering the annual supplies of seeds for 1872, the Seedsmen have been specially instructed to have each individual Member's share separately packed in hermetically sealed tin cases before shipment, to guard against a recurrence of the extraordinary dampness complained of last year, which not only destroyed the vitality of imported varieties, but also to a great extent well-gathered and well-dried acclimatized seeds. The Council desire to record the sense they entertain of the good feeling evinced by Members generally throughout the vexatious disappointment

experienced in the non-germination of the seeds and are in hopes the steps now taken will prevent a recurrence of failure.

The arrears from Members on the closing of the Accounts for 1871, is a trifle less than that shewn in 1870, *viz.*, 1,777-8-11 against Rs. 1,790-3-6. These also contrast favorably, shewing that the working of the Society in 1871, yielded Rs. 42,896-1-2 against Rs. 41,874-12-11 the previous year.

While remarking on the "arrears" the Council have to record that the large sum of Rs. 6,786-15-1 shewn in the Memorandum or Summary of Accounts for 1870 due from Members for upwards of three and more years, has at length been written off to the debit of Profit and Loss Account as hopelessly irrecoverable. Of the balances of arrears due from Members for the years 1868, 69 and 1870, the following disposition has been made.

The sum of Rs. 264-10 has been written off to the debit of Profit and Loss Account out of the Rs. 307-9-0 still due from Members who availed of the privileges of their Membership for the year 1868, and Rs. 116-10-6 out of Rs. 126-3-6 due from Members who participated in the year 1862, leaving the "arrear list" on the 31st December, 1871, as follows:

Arrears for	1868,	supposed good,	Rs.	42	15	0
Do.	1869	do.	„	9	9	0
Do.	1870	do.	„	214	9	0
Do.	1871	do.	„	1,777	8	11
			Rs.	2,044	9	11

It gives the Council pleasure to mention that the rule requiring the publication of the names of ex-members and others who after availing themselves of the privileges of their Membership, repudiated their liability to pay the balance of subscription, &c., for the year, has worked satisfactorily.

The liabilities of the Society for the year under review are slightly less than that of the previous year, *viz.*, Rs. 6,320 against Rs. 6,508; but it will not suffice to pass over the difference, although favorable, without further remarks. In 1870, the Society remitted to Seedsmen and others at Home Rs.

6,676-3-7, leaving a liability of Rs. 6,508 to be met out of the receipts of 1871. The amount remitted in 1871 exceeds the sum of Rs. 17,000; being more than Rs. 11,750 in excess of that remitted the previous year. That the balance of liabilities for the year 1871 should still be heavy is easily accounted for. In no previous year did the Society indent for so large and varied a collection of seeds at such greatly increased expense as in 1871, and on no previous occasion had it been rendered necessary to throw away the seeds in such large quantities as in the past year.

The Council cannot close this portion of the report without offering some remarks for the consideration of Members, relative to seeds, foreign and indigenous, which from time to time are presented to the Society and held available to Members for experimental trial and report.

These seeds are freely taken by Members, but it is rarely that any returns are made of the result of sowings, which is unfortunate, as such omission on the part of Members cannot fail to be prejudicial to the interests of the Society, as it will deter such free contributors from operating with the Society. The object of such returns is to enable the Society to publish the result of the sowings, and if this information be withheld, the utility of the Society is crippled.

The arrangements with the Royal Botanic Garden to meet the applications of Members for plants has continued to work tolerably well. The Council are indebted to the Superintendent and Curator of the Garden for their kind co-operation in supplying a portion of the plants—and in several instances rare plants—which the present limited stock remaining in the ground formerly occupied by the Society, rendered so desirable. The despatch of cuttings by pattern post, commenced in 1870, continues to progress satisfactorily. The total number of cuttings has aggregated 14,600. In addition to these, there has been a total distribution of 2,389 fruit-grafts and 8,423 ornamental plants to rather more than 200 applicants.

The Council are glad to be able to notify, in connection with this subject, that their application to Government for the piece

of land to the South of Belvedere has proved successful. This spot contains about 42 beegahs or 14 English acres. It has been transferred to the Society in perpetuity on condition of their relinquishing the annual grant from Government of Rs. 5,000, and on the understanding that it will not be appropriated to any other purpose than that of an Agri-Horticultural Garden. This condition has been accepted and possession of the land will be taken from the commencement of 1872. The Council take this opportunity of congratulating the Society on having at length secured a piece of ground in so desirable a locality; on which to resume those active operations which have been suspended for some time past, as well as to hold their periodical exhibitions of vegetables, fruits, and flowers. The correspondence connected with the transfer of this land is fully recorded in the Proceedings for September.

The annual exhibition of vegetables and flowers was on a necessarily limited scale consequent on the non-obtainment of tents having rendered it necessary to hold it in the Metcalfe Hall. Several novelties in the floricultural department and some good specimens of vegetables were submitted, but the general collection was altogether inferior to former years.

Several rare plants have been introduced at the ordinary monthly meetings. Messrs. Lynam, Mowbray, Rogers, Pigott, Cheetham, Price, and the Rajah Suttyanund Ghosal have contributed. A few plants have also been submitted by the Royal Botanic Garden.

A correspondence has recently taken place with the Government of Bengal on the subject of holding another exhibition in January, 1873, similar to that held in January, 1864, under Government auspices. The Council entered fully into the question of persevering, and well-sustained efforts being made for the improvement of Agriculture, through the medium of such periodical shows; but His Honor the Lieutenant-Governor was not prepared for reasons stated, *viz.*, the Census and Cess work in hand, to pledge himself to an early exhibition.

Since the publication of the last Report, the Government of India has inaugurated a department of Agriculture, Revenue,

and Commerce, which the Council trust will probably become more useful, as in the progress of time it obtains a fair insight into the varied requirements of this vast country. The Council has already been able to supply some valuable information to this department and hopes to continue a correspondence likely to tend to mutual advantage.

Allusion was made in the last Report to the offer of a prize for the best paper on the cultivation of the tea plant and manufacture of tea. This has been responded to by the receipt of eleven treatises, some from the hills, the others from the plains. These are now before the judges specially appointed to report on them and the result of their adjudication may be shortly expected.

Various tropical products such as tobacco, silk, cotton, Carolina paddy and fibrous materials, have been constantly brought before the Society during the past 12 months, and several interesting papers regarding them have been submitted. The Society has been in communication with the Acclimatisation Societies of Sydney and Melbourne regarding the wild silk-yielders of India. The important question of tree planting in Upper India has likewise been engaging attention. It is satisfactory to learn, on the best authority, that in the Punjab which is the most denuded of trees of any of the provinces of Upper India, Government is now spending nearly a lakh of rupees annually by direct agency on plantations; and that in the North-West Provinces, a special officer has been appointed for the propagation of fruit trees at Raneekhet, for distribution over the country. The introduction of a system of cultivation and preparing of tobacco, possessing first-rate qualities, is still a desideratum. Much care is doubtless necessary as respects the curing, but now that increased attention is being attracted thereto, we may reasonably hope to see this difficulty overcome at no very distant day, and our tobaccos take their proper place as a staple Indian article.

Two numbers of the Journal have been published during the year under review, *viz.*, Part 2, Vol. II., and Part 1, Vol. III., new series. They both contain much interesting information. The "Notes on Horticulture in Bengal" from the pen of Mr. John

Scott, Curator of the Royal Botanic Garden, and "Remarks on the pruning of Tea" by Dr. George King, Superintendent, Royal Botanic Garden, are especially valuable. Several other interesting communications from various members have also been published during the year in the "Proceedings," under the head of "Horticultural Notes." The Council consider that they cannot better close this brief review of the history of the past year than by inviting more frequent contributions from the many members scattered all over the country. It cannot be denied that the number of correspondents has not increased in proportion to the number of subscribers. If only one member in ten would contribute an item of practical information, founded on facts and the result of his own experience,—not deterred as too many seem to be by the idea that such information is well-known or has been previously communicated,—a mass of important observations would be speedily collected which would tend to the advance of agriculture and horticulture in India, for—it should always be remembered—to quote the words of the honoured founder of the Society—that "a body of men engaged in the same pursuit form a joint stock of their information and experience, and thereby put every individual in possession of the sum total acquired by them all."

Statement of Receipts and Disbursements of the AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA, *from 1st January to 31st December*, 1871.

RECEIPTS.

From Members—Subscriptions collected during the year ...	...	...				23,005	5	0
From Government Annual Donation	...	...				5,000	0	0
„ Accruings of Interest from Government Securities, &c.	...		1,771	2	4			
From Accruings of Interest on other Investments ...	...		99	15	0			
						1,871	1	4
From Proceeds of Country Vegetable and other seeds ...			354	5	3			
From Proceeds of fruit grafts ...			1,345	11	0			
„ „ of Surplus Stock of American and English vegetable and flower Seeds			3,607	0	0			
From Proceeds of copies of publications of the Society ...			181	0	0			
From Proceeds of Camphor wood boxes sold			20	12	0			
From Members—Amount for glazed cases, pots, packing charges for seeds, &c. ...			4,118	10	0			
From Proceeds of seed Cabinets sold			525	8	0			
„ Amount of freight re-paid ...			577	4	9			
„ „ of Suspense Account in deposit for appropriation on various account ...			508	7	8			
„ Estate of Pertab Narain Singh			3	7	3			
						11,242	1	11
TOTAL RECEIPTS, Rupees ...	...	...				41,118	8	3
Balance in the Bank of Bengal on the 31st December, 1870...	...	...				1,762	7	0
GRAND TOTAL, Rupees		...				42,880	15	3

DISBURSEMENTS.

By Messrs. James Carter & Co., for seeds supplied in 1869 ...	3,631	4	2			
„ Messrs. Vilmorin, Andrieux & Co., seeds supplied in 1870 ...	2,587	9	6			
„ Messrs. Law, Somnes, & Co., for seeds supplied in 1870 and 1871	2,839	8	0			
„ Messrs. Barr & Sugden for seeds supplied in 1871 in part ...	6,679	13	4			
„ Messrs. D. Ladreth & Son for seeds supplied in 1871 in part	2,031	12	0			
				17,769	15	0
Carried over ...				17,769	15	0

	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Brought forward ...				17,769	15				
By Sundry parties for country vegetable seeds, potatos, wheat, &c.	249	5	0						
„ Sundry parties for English and French vegetable seeds for further free distribution to such Members who signified failure of the imported annual supplies	267	2	0						
„ And for cost of fruit grafts, pots, Wardian cases, boxes, &c., on account of Members including cost of analizing certain specimens of earth	481	5	9	997	12	9	18,767	11	9

LIBRARY ACCOUNT.

	Rs.	a.	p.	Rs.	a.	p.
By Sundry parties for Books purchased ...	246	11	0			
„ „ binding Books... ...	43	8	0			
				290	3	0

PRINTING ACCOUNT.

	Rs.	a.	p.
„ Sundry parties for printing letters of calls money receipts, &c., &c.	238	12	0

JOURNAL ACCOUNT.

	Rs.	a.	p.	Rs.	a.	p.
„ Messrs. T. Black & Co., printing 700 copies of Journal Vol. 2, Part II., New Series and 750 copies of Vol. 3, Part I. ...	1,411	8	9			
„ City Press printing Proceedings of Meetings ...	513	12	0			
„ Bishop's College Press, printing Lists of Members, Index to Roxburgh's Flora Indica, and sundry other work	430	5	6			
„ Sundry parties for preparing matters for the Journals	50	0	0			
				2,405	10	3

NURSERY GARDEN.

	Rs.	a.	p.	Rs.	a.	p.
„ Establishment from December, 1870, to November 1871	1,001	9	3			
„ Purchase of seedlings, pots, boxes, Wardian cases, including Dinghy hire, &c. ...	826	15	3			
				1,828	8	6

NEW GARDEN ACCOUNT AT ALIPORE.

	Rs.	a.	p.	Rs.	a.	p.
„ Rent of house for October and November, 1871	200	0	0			
„ For purchase of 100 Rose grafts	150	0	0			
				350	0	0

ESTABLISHMENT ACCOUNT.

	Rs.	a.	p.
„ Office Establishment from December, 1870, to November, 1871	11,548	1	9
Carried over ...	35,428	15	3

Brought forward ...				35,428	15	3
ADVERTISEMENT ACCOUNT.						
By Advertising Notices of Meetings and seeds for distribution, &c., &c.				203	9	6
FREIGHT ACCOUNT.						
„ Freight paid on boxes of seeds, books, &c., from London, Melbourne, &c.;	794	10	7			
and on packages of seeds, &c., sent to Members	715	1	0			
				1,509	11	7
FURNITURE ACCOUNT.						
Sundry parties for purchase of furniture ...				1,014	14	0
METCALFE HALL ACCOUNT.						
Proportion of House, Police, and Lighting rates from October, 1870, to September, 1871, and water rates to 31st December, 1871...	661	8	0			
„ Sundry petty repairs, &c.	59	7	3			
				720	15	3
STATIONERY ACCOUNT.						
„ Sundry parties for stationery				79	3	6
REFUND ACCOUNT.						
„ Sundry parties for balance of accounts refunded				84	6	11
FLORICULTURAL SHOW ACCOUNT.						
„ Sundry parties for cost of decorating the Hall and other petty expenses	368	4	3			
„ Sundry parties as pecuniary rewards ...	428	0	0			
„ Messrs. Hamilton & Co., cost of engraving inscription on silver medal, presented to A. H. Mowbray, Esq.	10	0	0			
				806	4	3
TEA ESSAY ACCOUNT.						
„ Sundry parties advertising prize for the above ...				51	8	6
SEED CABINET.						
„ Payments on this account				615	8	0
PETTY CHARGES ACCOUNT.						
„ Postage on Letters, Journals, &c., sent and received	248	3	2			
„ Bank of Bengal cost of stamped cheques Commission on interest drawn ...	10	9	9			
„ Punkawallahs, pensions, hackery, and Cooly hire, extra packermen, landing and forwarding charges, cost of tin and wax cloth, sealing-wax, tin-men, carpenters, gunny-men, &c., &c.	839	10	4			
				1,098	7	3
Rs. ...				41,613	8	0
Balance in the Bank of Bengal on 31st December, 1871				1,267	7	3
GRAND TOTAL, Rupees ...				42,880	15	3

MEMORANDUM.

Disbursements.

		Rs.	a.	p.
To Amount of Disbursements during the year 1871, as per Statement ...		41,613	8	0
" Balance in the Bank of Bengal on 31st December, 1871		1,267	7	3
Total, Rupees		42,880	15	3

Receipts.

		Rs.	a.	p.
By amount of Receipts during the year 1871, as per statement		41,118	8	3
" Balance in the Bank of Bengal on 31st December, 1870		1,762	7	0
Total, Rupees ...		42,880	15	3

Liabilities.

Messrs. D. Landreth and Son, for Balance of seeds received in 1871	£ 350	0	0			
" Barr and Sugden, for Balance of seeds received in 1871 ...	" 225	0	0			
" Law, Somners, and Co., for Balance of seeds received in 1871	" 20	0	0			
" Vilmorin, Andrieux, and Co., for Balance of seeds received in 1870	" 25	0	0			
" H. S. King and Co., for Balance Account Books and periodicals supplied	" 12	0	0			
Total;	£ 632	0	0			
or Rupees				6,320	0	0

Dependencies.

Amount invested in Government Securities, lodged in the Bank of Bengal	42,833	5	3			
" of cash balance in the Bank of Bengal	1,267	7	3			
				44,100	12	6
Balance of Subscription, &c., due from Members who participated in the privileges of the Society in the years 1868 to 1871 as follows:						
Balance of Subscription ...	1,152	14	5			
" of seeds, grafts, Journals, freight, &c. ...	891	11	6			
				2,044	9	11
Total, Rs.				46,145	6	5

LIST OF MEMBERS

OF THE

Agricultural and Horticultural Society

OF

INDIA.

DECEMBER 31st, 1871.

ALPHABETICALLY ARRANGED

AND

DISTINGUISHING THE YEAR OF ADMISSION

Office Bearers.

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Vice Presidents:

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HIS EXCELLENCY THE RIGHT HON'BLE EARL OF MAYO.

List of Members.

* This mark denotes Members who have compounded for their Annual Subscriptions.

† This mark denotes Members who are absent from India, and therefore non-contributors.

‡ This mark denotes Members who, though absent, are desirous of continuing their Subscriptions.

HONORARY MEMBERS.

The Right Honorable Sir Edward Ryan, A. M., F. A. S., London	1828	1841
J. Mackay, Esq.		
Don Ramon de la Sagra, Island of Cuba ...		
Dr. Justus Leibig, Professor of Chemistry in the University of Giessen		1843
The Right Honorable Sir Lawrence Peel, London	1842	1856
R. Fortune, Esq.		1856
A. Grote, Esq., London	1837	1868
The Revd. T. A. C. Firminger, London ...	1851	1868
Baboo Peary Chand Mittra, Calcutta... ...		1871
John Scott, Esq., Curator, Royal Botanical Garden, Seebpore		1871

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D. J. MacGowan, Esq., M. D., Ningpo ...	1851
Mons. Natalis Rondot, Paris	1858
Capt. Thos. Hutton, F. G. S., Mussoorie ...	1861
Lieut.-Col. W. H. Lowther	1864
James Cowell, Esq., London	1864
Dr. H. Cleghorn, Edinburgh	1867
Vause, Fretwell, Esq., Supdt. of Model Farms at Bhurgaums, Kandeish	1869
C. Brownlow, Esq., London	1870
Lieut. J. F. Pogson, Umballa	1870
Dr. George King, Supdt., Royal Botanical Garden, Seebpore	1870

ASSOCIATE MEMBERS.

Capt. E. P. Nisbet, London	1842
Geo. Bartlett, Esq., Calcutta	1870

ORDINARY MEMBERS.

A.

	Admitted.
ABBOTT, Horace, Esq., Rajahpore via Koosteah	1858
Abbott,† Lieut.-Col., J. R.	1865
Abdool Gunny, Kajee, Zemindar, Dacca	1860
Adams, G. Esq., Civil Service, Saharunpore	1870
Ady, Charles, Esq., Merchant, Moulmein	1864
Ainslie, Hon'ble W., Civil Service, Calcutta	1847
Aitchison, W. Esq., Manager, Doloo Tea Garden, Cachar	1869
Alexander, N. Stuart, Esq., C. S., Malda	1864
Alexander, W. Esq., Merchant, Calcutta	1865
Alexander, Lieut.-Col. W. K. E., 1st Bengal Cavalry, Cawnpore	1867
Alexander, Lieut. G., Assistant Commissioner, Rangoon	1870
Allen, Thomas Tayler, Esq., C. S., Beerbhoom	1866
Ameer Allee Khan, Moonshie, Bahadoor, Calcutta	1869
Anderson, Lieut.-Col. W. W., Political Agent, Kattywar	1859
Ankey, George, Esq., Civil Engineer, Purneah	1861
Anthony, Adam, Esq., 1st Assistant Accountant-General, Allahabad	1870
Archer, Revd. J. B., Parsonage, Kurseong	1869
Armstrong, C. M., Esq., Opium Dept., Bareilly	1858
Armstrong, T. W., Esq., Supdg. Engineer, Takly, Nagpore, Central Provinces	1862
Armstrong, Joseph Samuel, Esq., C. S., Hajeepore, Tirhoot	1865
Ashburner, Lieut.-Col., John, (Bombay Staff Corps) Deputy Commissioner, Upper Godavery, C. P.	1864
Assistant Commissioner, Pachmari, Hoshungabad Dist.	1871
Atkinson, W. S. Esq., Director, Public Instruction, Calcutta	1864
Austen,† Capt. Godwin, Survey Dept.	1867

B.

BADGER,† A. Esq., Manager, Equitable Coal Company's Colliery	1867
Bainbridge, A. R. Esq., Civil Service, Midnapore	1868
Baird, Lieut.-Col. A. F. Executive Engineer, Cawnpore	1861
Banister,† Dr. G.; F. R. C. S., Governor General's Body Guard	1868
Barlow, G. N. Esq., Civil Service, Monghyr	1864
Barnes, C. H. Esq., Julpigoree	1863
Barstow,† H. C. Esq., Civil Service	1868

	Admitted.
Bartlett, Lieut.-Col. H. T., Bengal Staff Corps, Saugor ...	1865
Barker, Dr. R, A., Civil Surgeon, Beerbhoom ...	1870
Barron, Capt. W., Dy. Supdt, Revenue Survey, N. W. Frontier, Dera Ghazee Khan	1871
Bayley, E. C., Esq., Civil Service, Calcutta	1863
Bayley, Stuart Colvin, Esq., Civil Service, Calcutta ...	1859
Beadon, Henry, Esq., Civil Service, Calcutta ...	1867
Beames, John, Esq., Civil Service, Balasore ...	1871
Beaufort, Francis L. Esq., Civil Service, Calcutta ...	1838
Beaumont, Dr. Thomas, Residency Surgeon, Indore ...	1870
Becher, William, Esq., Gowhatti	1855
Becher, J. M. Esq., Indigo Planter, Mozufferpore Tirhoot	1862
Becher, Colonel S. Commanding Troops, Delhi ...	1870
Beckett, W. O. A., Esq., Dy. Commr., Cooch Behar ...	1871
Beeby, G. O. Esq., Solicitor, Calcutta	1866
Beer Chunder Manick, Bahadoor, Maharajah of Tipperah	1870
Bejoy Kesub Roy, Bahadoor Rajah of Andool ...	1870
Benode Behary Banerjee, Calcutta	1871
Bennett, T. B., Esq., Lallpore Factory, Purneah ...	1871
Benson,† Colonel J. C.	1863
Benson, George, Esq., Pleader, High Court, N. W. P., Bareilly	1868
Bentall,*† Edward, Esq., Civil Service	1837
Berkeley, L. Esq., Commr., Paper Currency, Calcutta ...	1855
Berkeley, Vilters, Esq., Judge, Small Cause Court, Nynee Tal	1869
Bertelson, H. H. F. Esq., Tea Planter, Mohurgong, Darjeeling	1868
Betts, C. G. D. Esq., Ourungabad via Pakour ...	1867
Beveridge, H. Esq., C. S., Backergunge	1865
Bhopal,* H. H. the Begum of	1870
Bhowany Sing,* Maharajah, Duttea	1864
Bhugwan Sing, Sirdar, Umritsur	1871
Bhugeruttee Mohendra, Bahadoor, Maharajah of Killoh, Dewkonull	1871
Bickham,† Geo. Esq., Merchant	1869
Bignell, R. A. D'O. Esq., Assistant Superintendent of Police, Jessore	1867
Bimala Churn Bhuttacharjea, Deputy Collector and Magistrate, Nowada via Behar	1870
Bird, Col., J. W. L., Morar	1871
Birch, Capt. R. G. Cawnpore	1867
Birch, Lieut. H. H., 27th P. N. I. Bareilly	1869
Bishop,*† Major H. P. (Artillery)	1853
Blacker, G. M. Esq., Merchant, Calcutta	1856

Admitted.

Blanchett, J., Esq., Register General's Dept., Allahabad... 1871
Blathwayt, Capt. L., Asst. Commr., Golaghat, Seebsaugor 1871
Blechynden, R. Esq., Merchant, Calcutta 1858
Blechynden, A. H. Esq., Secretary, Agri.-Hort. Society of India, Calcutta 1851
Boddam, Col., Hungerford, Dy. Commr., Hazareebaugh ... 1871
Bourchier, Brigadier-General G. C., B., Royal Artillery, Shillong 1868
Bourne, Walter, Esq., Resident Engineer, E. I. Railway, Assensole 1855
Bowser, H. C. Esq., Civil Surgeon, Rungpore ... 1865
Brae, T. Esq., Dabracole, Commercolly, E. B. Railway ... 1854
Brandis,† Dr. D., Supdt. of Forests 1857
Brander, James, Esq., E. B. Railway, Sealdah ... 1865
Bridgman, J. H, Esq., Gorruckpore 1868
Brock, Charles Esq., Merchant, Calcutta 1867
Brodhurst, M. Esq., Civil Service, Benares 1859
Brodie,*† Major T. 1836
Broucke, W. J. Esq.. Indigo Planter, Bhugha Factory, via Chumparun 1859
Broughton, E. Esq., Merchant, Calcutta 1865
Brown,† Dr. Robert, Political Agent 1868
Brown,‡ Walter, R. Esq., Merchant 1869
Browne,† Lord Ulick, Civil Service 1867
Browne,† Revd. J. Cave 1866
Brown, Forbes, Scott, Esq., Merchant, Penang ... 1840
Brown, Col. D., 1st Madras Fusiliers, Tenasserim Division 1856
Brown, J. A. Esq., Superintendent of Roads, Cachar ... 1870
Browning,† Fred. R. Esq , Civil Engineer, E. I. R. Chord Line 1867
Brooke, R. P. Esq., Bubnowly, Goruckpore ... 1871
Buck, E. Esq., C. S., Cawnpore 1870
Buckingham, J. Esq., Tea Planter, Amgoorie via Morar Bazar, Seebsaugor Assam 1867
Buller,*† Frederic Pole, Esq., Civil Service ... 1837
Bury, Percival, Esq., Tea Planter, Deedurkoosh, Cachar 1869
Buskin, E. G. Esq., Calcutta 1864
Buskin, M. Esq., Serepore Factory, Chuprah ... 1870
Butt, Geo. Esq., Civil Service, Shajehanpore ... 1866
Byrne, Walter A. Esq., Opium Department, Ghazeepore 1870

C.

Calder, G. L., Esq., E. B. Railway, Kanchraparah ... 1871
Cameron,† Dr. J. McLeod, Civil Surgeon 1865

C.—(*Continued*).

Admitted.

Cameron, J. T. D. Esq., Calcutta 1869
Campbell, W. E. Esq., Comillah 1838
Campbell,*† Archibald, Esq., M. D. 1838
Campbell, Hon'ble Geo. Lieut.-Govr. of Bengal, Calcutta 1865
Campbell, Major A. E. Dy. Commr., Seebsaugor, Assam... 1871
Campbell, N. J., Esq., Kurnoul Factory, Tirhoot ... 1871
Campbell, D. W. Esq., Locomotive Supdt., E. I. Railway, Jamalpore 1870
Carew,* R. R. Esq., Shajehanpore 1846
Cargill, T. U. Esq., Cossipore 1871
Carleton, C. F. Esq. Indigo Planter, Meerpore, Moteeharry Chumparun 1868
Carnac,† C. F. Esq., Civil Service Ghazeepore ... 1865
Carnac, H. Rivett, Esq., Cotton Commissioner, Allahabad 1869
Carrick, Henry, Esq., Locomotive Supdt., E. I. Railway, Jamalpore 1863
Carter, J. H. Esq., Civil Service, Allyghur 1870
Carter, T. E. Esq., Merchant, Calcutta 1870
Castle, C. T., Supdt. of Police, Banda 1865
Chambers, Charles, Esq., Civil Engineer, E. I. Railway, Jamalpore 1868
Chardon, W. B. Esq., Seepah Factory, via Arrah ... 1864
Chauntrell, F. D. Esq., Solicitor, Calcutta 1870
Cheetham, W. H. Esq., Merchant, Calcutta 1870
Chennell, Thos. Esq., Dewan Tea Estate Debrooghur, Upper Assam 1870
Chester,† Capt. H. D. E. W. Offg. S. A. C. G. ... 1869
Chrestien,† T. Esq., Banally 1864
Christian, A. Esq., Indigo Planter, Oomgong Factory, Mudhoobanee, Tirhoot 1869
Chunder Kaunt Mookerjee, Baboo Calcutta 1866
Clark, Dr. Stewart, Inspector-Genl. of Prisons, N. W. P., Allahabad 1855
Clarke, H. P. Esq., Cinnatoliah, North Luckimpore via Jorehaut Assam 1870
Clay, A. L. Esq., Dept. Commr., Chittagong ... 1868
Cockburn, J. F. Esq., Kanoo Junction, Burdwan ... 1866
Cogswell, W. H. Esq., Calcutta 1866
Cole, Revd. J. Supdt. Lawrence Asylum, Sanawur ... 1865
Collis,† S. E. Esq., Solicitor 1859
Collis, F. S., Esq., Barrister-at-Law, Calcutta ... 1871
Colvile,*† Sir J. W. 1849
Colvin, B. D. Esq., Merchant, Calcutta 1868
Comley, J. M. Esq., Calcutta 1871
Commandant of the Deolee Irregular Force, Deolee via Jeypore 1871

C.—(Continued.)

Admitted.

Commandant of the Erinpoorah Irregular Force, Erinpoorah 1871
Comber, B. E. C. Esq., Tea Planter, Debrooghur ... 1870
Conroy, G. H. W., Esq., Chief Store-keeper, E. I. Railway, Calcutta 1871
Conti, Geo. Esq., Calcutta 1870
Connell, T. Esq., Sildoobie Garden, Cachar 1870
Cooke, F. C. Esq., Bhaugulpore via Azimghur and Toortiepore 1866
Cope,† Henry, Esq., Merchant 1847
Corbyn, the Revd. H. Abbottabad, Hazara, Punjab ... 1865
Corbyn, Capt., E. C., Dy. Commr., Shahpore, Punjab ... 1871
Corbett, Major A. F., District Superintendent of Police, Budaon 1871
Cornell, W. Esq., Civil Service, Mymensing ... 1861
Cosserat, Lewis Esq., Indigo Planter, Burhogah via Chupra 1859
Courjon, Alfred, Esq., Zemindar, Chandernagore ... 1863
Courjon, Achille Esq., Chandernagore 1869
Cowley, F. W. R. Esq., Civil Service, Comillah ... 1867
Coxhead, T. E. Esq., Joint Magistrate, Gya 1868
Craddock, Dr. W., 1st Goorkah Regt. Dhurumsalla ... 1868
Craster, E. C. Esq., Civil Service, Soory, Beerbhoom ... 1858
Crawford, J. A. Esq., Civil Service, Calcutta, *(President)* 1857
Craven, James, Esq., Monghyr 1871
Crommelin, C. R. Esq., Pertabghur, Oude 1860
Crommelin, Lieut.-Col. J. A., Darjeeling 1857
Crosthwaite, R. J. Esq., B. A., C. S., Budaon ... 1869
Cumberlege,† Major-General E. A. 1866
Cumming, W. Esq., Indigo Planter, Rajmehal ... 1851
Cummins, J. G. Esq., Telegraph Master, Cachar ... 1870
Currie,† Capt H. O., 19th Hussars 1865
Currie, G. M. Esq., Civil Service, Cuttack 1868
Curtis,‡ J. F. Esq., Indigo Planter 1860

D.

DACOSTA, Joseph, Esq., Pleader, Civil Court, Bhaugulpore 1865
Dalton, Lieut.-Colonel E. T., Commissioner of Chota Nagpore 1848
Daly, F. D. Esq., Manager, Simla Bank, Umballa ... 1867
Daly, R. M. Esq., H. M. Bengal Marine, Calcutta ... 1869
Daswhood, H. W. Esq., Civil Service, Agra ... 1860
Daunt, W. Esq., Mozufferpore Tirhoot 1857
Davies, Lieut.-Col. J. S., Judicial Commissioner, Chota Nagpore 1857

D.—(Continued.)

	Admitted.
Dalbusset, E. Esq., Calcutta	1871
Dalton, G. B. T., Esq., Civil Service, Monghyr ...	1870
Davies,† Lieut.-Col. F. T.	1869
Davis, W. P. Esq., Bengal Police, Midnapore ...	1870
Davidson, James, Esq., Debrooghur Assam	1870
Dear, Herschel Esq., Monghyr	1860
Debendra Nath Mullick, Baboo, Calcutta	1870
DeHoxar, C. F. F., Esq., Indigo Planter, Allahabad ...	1871
Delane,† Major G.	1864
Delauney, J. P. Esq., Indigo Planter, Commillah, ...	1862
Deputy Commissioner of Sumbulpore	1866
Deputy Commissioner of Oomraottee	1869
Deputy Commissioner of Ellichpore	1869
Deputy Commissioner of Woon	1869
Deputy Commissioner, Booldana District	1871
Deputy Commissioner of Bassim, West Berar ...	1871
Deveria, J. Esq., Zemindary Manager, Bengal Coal Company, Raneegunge	1866
Deverell, H. Esq., Indigo Planter, Ackrigunge Factory via Berhampore	1854
Deverell, F. R., Esq., Merchant, Calcutta	1871
Dias, T. C. Esq., Advocate, Moulmein	1866
Dias, J. F., Esq., Calcutta	1871
Dickens, Lieut.-Col. C. H. Artillery, Calcutta ...	1856
Dickson,† G. Esq., Secy. and Treasurer, Bank of Bengal	1863
Dodgson, W. Esq., Kallygunge Factory, Rungpore ...	1864
Duff, W. P. Esq., Merchant, Calcutta	1867
Duffin, Col. R. H. M. Bengal Army, Umballa ...	1868
Drummond, E. Esq., Civil Service, Patna	1866
Drury, Col. C. C., Police Department, Lucknow ...	1860

E.

Earle, Dr. F. J., Civil Surgeon, Kishnaghur ...	1859
Eddy, H. C. Esq., Dacca	1865
Eden, Hon'ble A., Civil Service, Rangoon	1870
Edgar, J. W., Esq., Civil Service, Cachar	1869
Edwards, Anthony, Esq., Meerpore Factory, Mootteeharree, Chumparun	1866
Edgar, E. L., Esq., Tea Planter, Cossipore Factory, Cachar	1871
Egerton, R. E. Esq., C. S., Punjab	1864
Eisenlohr, F. Esq., Merchant, Calcutta	1870
Eldridge,† F. G. Esq., Merchant	1867
Eliot, Col. John, Artillery, Morar	1839
Erskine, H. C. Esq., Indigo Planter, Elambazar, via Bhulpore	1855

F.

Admitted.

FAGAN, G. S., Esq., 1st Judge S. C. Court, Calcutta ...	1855
Fairley, W. C. Esq., Merchant, Rangoon ...	1866
Falcon, A. B. Esq., Civil Service, Rungpore ...	1858
Farquhar, Capt. J. H. T. Stud Deptr, Poosa, Tirhoot ...	1869
Fergusson, Hugh, D. Esq., Indigo Planter, Allyghur ...	1867
Ferris, Dr. G. R., Calcutta	1865
Fisher,† Lieut.-Col., G. B., District Supdt. of Police ...	1865
Fisher, J. H., Esq., Civil Service, Allahabad	1871
Forbes, Major, H. T. Kishnaghur	1856
Forbes, A. Esq., Civil Service, Tajpore, Tirhoot ...	1869
Forbes, Lieut. James, Dum-Dum	1869
Forbes, J. C. M. Esq., C. E., Assistant Engineer, Kurruchpore via Monghyr	1870
Forbes, L. R. Esq., Extra Assistant Commissioner, Chota Nagpore	1871
Forlong, Lieut.-Col. J. G. R., Rajpootana	1870
Francis, T. M., Esq., Solicitor, Calcutta	1871
Franklin, Capt. W., H. M.'s 76th Foot, Secunderabad, Hyderabad Deccan	1870
Fraser, W. F. Esq., Bank of Bengal, Bankipore ...	1867
Fraser, G. Esq., Indigo Planter, Gopalpore Factory, Jaunpore	1870
Fraser, Major the Hon'ble W. M., Meerut	1870
Freeman, H. Esq., Lall Serriah Factory, Seegowly, Chumparun	1866
Fox, Mrs. Annie, Singhesur, Bhaugulpore	1871
Fukeerooddeen, Prince Mahomed, Hooghly	1868
Fytche,† Col. A.	1849
Fyz Allee Khan, Nawab, Bahadoor, Jeypore ...	1871

G.

GALIFFE, J. F. Esq., Collector of Canal Tolls, Calcutta ...	1856
Garbett, Lieut. C. H. Asst. Commr., Maunbhoom ...	1868
Gasper, N. M. Esq., Pleader, Small Cause Court ...	1871
Gibbon, T. M. Esq., Indigo Planter, Betteah Factory, Tirhoot	1860
Gibbon, W. F. Esq., Senr., Doolha Factory, Goruckpore...	1870
Gilbert, Edwin, Esq., Ex-Engineer, C. I. Administration, Morar	1871
Gillam, F. A. Esq., Agent, Bank of Bengal, Mirzapore ...	1870
Glascott, G. A. Esq., Locknathpore, Joyrampore, E. B. Railway	1871
Glass, J. Esq., Ex-Engineer, D. P. W. Nagpore, C. P. ...	1867
Goluck Chunder Bose, Baboo, Zemindar, Cuttack ...	1871

G.—(*Continued*).

	Admitted.
Goodeve, Lewis, Arthur, Esq., Barrister, Calcutta ...	1868
Gopeenath Roy, Baboo, Calcutta	1871
Gordon, D. T. Esq., Manager, Silk Filatures, Surdah ...	1859
Gordon, Col. John, Commanding at Jheelum ...	1871
Gordon, John Esq., Bank of Bengal, Calcutta ...	1865
Gouldhawke, J. Esq., Bahorah, Caragola ...	1851
Gowan, Lieut.-Col. J. Y., Bengal Staff Corps, 2nd in Command, 33rd Regt. N. I., Allahabad ...	1865
Grace, Geo. Esq.; Sylcooree, Cachar	1865
Graf, C. Esq., Merchant, Calcutta	1869
Graham, Joseph, Esq., Barrister-at-Law, Calcutta ...	1858
Graham, W. F. Esq., Indigo Planter, Colgong ...	1862
Graham,† A. Esq., Merchant.	1868
Graham, Wm. Francis, Esq., M. C. S., Chicacole ...	1871
Grant, Thomas, Esq., Indigo Planter, Bhagulpore ...	1848
Grant, G. H. Esq., Indigo Planter, Bhagulpore ...	1859
Grant, John Peter, Esq., Junr., Civil Service, Moorshedabad	1860
Grant,† T. R. Esq., Merchant	1863
Grant, C. Esq., Lebong, Darjeeling	1864
Gray, J. J. Esq., Indigo Planter, Dacca	1846
Gray, Henry A. Esq., Solicitor, Calcutta ...	1869
Gray, Dr. Edward, Medical Officer, Jorehaut Tea Company, Cinnemara, Assam	1868
Grey, Lieut., L. J. H., Asst. Commr., Lohardduggah ...	1871
Greenwood, W. J. Esq., Asst. Commr., Lullutpore ...	1871
Greenhill,† T. Esq., V. S.	1865
Gregory, J. A. Esq., Calcutta	1870
Gress Chunder Sing, Coomar, Zemindar, Pikeparrah near Calcutta	1867
Grey,† The Hon'ble W.	1867
Grey, E. Esq., Moorshedabad	1868
Griffiths, S. P. Esq., Merchant, Calcutta ...	1844
Griffith, Ralph Esq., Principal, Queen's College, Benares	1870
Grote, A. G. Esq., Baraitch, Oude	1866
Growse, F. S. Esq., Muttra.	1870
Grylls, Dr. W. R., Civil Surgeon, 16th M. N. I., Bellary	1867
Guavain, Capt. V., Commander of the Steamer *Meinam*, Calcutta	1871
Guise, J. J. Esq., Merchant, Calcutta	1867
Gungapershad, Baboo, Dy. Collector, Moradabad ...	1871

H.

Admitted.

HALKETT, D. C. Esq., Civil Service, Jaunpore ...	1870
Halsey, F. Esq., Manager, Branch Bank of Bengal, Umritsur	1863
Hall, R. W. Esq., Balladhun Garden, Cacha ...	1870
Hamilton, J. C. Esq., Indigo Planter, Nawadah Factory, via Durbhungah	1867
Hamilton, T. F. Esq., Merchant, Calcutta	1870
Hankin,† Major G. C.	1864
Harlow, Wm. Esq., Manager, Eastern Cachar Tea Company, Cachar	1871
Harris,† G. L. Esq., C. S.	1863
Harrison, H. A. Esq., Civil Service, Humeerpore ...	1863
Harrold, H. M. Esq., Tea Planter, Kalabaree, Darjeeling	1863
Haughton, Col. J. C., Commr., Cooch Behar, Julpigoree	1859
Hawkins,*† John Abraham Francis, Esq.	1837
Hawkins, Capt. E. L., R. A., Morar	1871
Haworth, J. H. Esq., Broker, Calcutta	1870
Hay, P. J. Esq., Manager, Sildoobie Tea Garden, Cachar	1870
Hayes, Dr. W. H. Chyebassa, Singbhoom	1861
Health Officer, Calcutta	1865
Heely, W. L. Esq., C. S., General Hospital, Calcutta ...	1864
Henderson,† Dr. G., Civil Surgeon	1863
Henderson, M. Esq., Merchant, Calcutta	1864
Heralall Seal,* Baboo, Calcutta	1858
Herbert,† Col. C.	1864
Herklots, D. G. Esq., Agriculturist, Calcutta ...	1870
Herschell, Sir W. J., Bart, Civil Service, Nuddea, Kishaghur	1870
Hewitt,† J. F. K. Esq., Civil Service	1860
Hill, Dr. J. H. G. Turcooleah Factory, Moteehareo Chumparun	1865
Hill, R. H. Esq., Seraba, Tirhoot	1865
Hills,*† James, Esq., Senior, Indigo Planter ...	1837
Hinde, W. H. Esq., Merchant, Calcutta	1869
Hindhaugh, T. S., Esq., Chowkeedangah, Raneegunge ...	1870
Hindmarsh, Thomas, Esq., Eastern Bengal Railway, Kanchraparah	1866
Hittoll Messer, Baboo, Zemindar, Mauncoor ...	1864
Hobart, R. T. Esq., Etah	1870
Hobday, Alfred Esq., Merchant, Moulmein	1866
Hogg, Capt. T. W. Assistant Commissioner, Hoshungabad	1868
Hollway, F. H. Esq., Indigo Planter, Monghyr ...	1863
Holloway,† Capt. E. V., 5th Irregular N. I. ...	1870
Holroyd, Col. Charles, Barrackpore	1866

	Admitted.
Homfray, J. N. Esq., Bengal Marine Service, Port Blair ...	1863
Hoskins, Dr. Civil, Surgeon, Ranchee	1870
Howard, Bernard, Esq., Merchant, Mirzapore ...	1868
Howard, Dr. J. S. Civil Surgeon, Oomraotee ...	1870
Howe, W. A. Esq., Bulleah, Ghazeepore	1870
Hudson, Cunningham, Esq., Merchant, Calcutta ...	1867
Hudson, C. E. Esq., Bugli Pinjra, Azimghur ...	1870
Hunter, Lieut. R., Asst. to Supdt. of Tributary Mehals, Keonghur	1871
Hurrendhur Kishore Sing, Baboo, Betteah, Tirhoot ...	1870
Hurst, J. Esq., Mussoorie	1870
Hutchinson, Col. A. R. E., Political Agent, Morar, Gwalior	1862
Hutchison, J. H. Esq., Merchant, Calcutta	1870
Hyslop, Archibald, Esq., Merchant, Bimlipatam ...	1867

I.

INSKIPP, C. T. Esq., Calcutta	1870
Ireland, Wm. DeCourcy, Esq., Dy. Commr. Akyab ...	1871
Irving,† Dr. James, Civil Surgeon	1867
Irwin, Lieut.-Col. W., Stud Dept., Saharunpore ...	1864
Isaac, Thos. S. Esq., Supdg. Engineer, Calcutta ...	1869
Ishore Persaud Narain Sing, Bahadoor, Rajah of Benares	1854

J.

JACK, E. A. Esq., Merchant, Calcutta	1863
Jackson, Hon'ble Elphinstone, Civil Service, Calcutta ...	1860
Jackson, Hon'ble L. S., Civil Service, Calcutta ...	1852
Jackson, Dr. C. J., Civil Surgeon, Berhampore ...	1861
James, A. H. Esq., Assistant Commissioner, Naga Hills, Assam	1868
Jameson, W. Esq., M. D., Saharunpore	1852
Jarrett, Capt. H. S., Staff Corps, Calcutta ...	1871
Jennings, C. B. Esq., Sylhet	1862
Jennings, Saml. Esq., Allahabad, F. R. H. S. ...	1863
Jogendronauth Mullick, Zemindar, Andool ...	1866
Johnstone, Capt. J., Special Asst. to Supdt. of Tributary Mehals, Keonghur	1871
Jones, Frederick, Esq., Civil Service, Serampore ...	1870
Jones, H. Lloyd, Esq., Bengal Police, Dinagepore ...	1871
Jones, W. H. Esq., Calcutta	1863
Joy Sing,* Deo Bahadoor, Maharajah of Chikari ...	1868
Joykissen Mookerjee, Baboo, Zemindar, Ooterparah ...	1852
Judge, W. J. Esq., Solicitor, Calcutta	1858
Jung,* Bahadoor, Maharajah, G. C. B., Nepal ...	1860

	Admitted.
KALEE Kissen Tagore, Baboo, Calcutta	1869
Kally Prosono Roy, Baboo, Zemindar, Noral, via, Jessore	1867
Kemp, Geo. Lucas, Esq., F. R. G. S., Secretary of the Standard Life Assurance Society, Calcutta ...	1871
Kennedy, J. Pitt, Esq., Barrister-at-Law, Calcutta ...	1867
Khettermohnn Sing, Baboo, Dinagepore	1870
Kidd, Dr. H. A., Civil Snrgeon, Mundla ...	1871
Kincaid, Lieut.-Col. W. Assistant Political Agent, Indore, Central India	1867
King,† R. W. Esq., Bengal Police ...	1861
Knowles, H. Esq., Merchant, Calcutta ...	1852
Knyvett, Capt. W. L. N., District Supdt. of Police, Berhampore	1864
Koomudnauth Roy, Coomar, Natore	1866
Kranss, Henry, Esq., Rangoon	1865
Kristinder Roy, Rajah, Boliehar, Rajshahye	1866
LAGARDE, F. Esq., Silk Manufacturer, Goorelee, via Ghattal	1866
Lamb, E. Esq., Pursah Factory, Chumparun ...	1870
Lamouroux,† F. Esq., Merchant	1863
Lance, C. E. Esq., Civil Service, Midnapore... ...	1858
Landale, Geo. A. Esq., Indigo Planter, Turtipore, Maldah	1868
Landale, Alex. Esq., Merchant, Calcutta	1869
Lane,† T. B. Esq., Civil Service	1855
Langlois, J. P. Esq., Tea Planter, Chittagong ...	1866
Larminie,† W. R. Esq., Civil Service	1862
Law, W. Trevor, Esq., Advocate, Moulmein ...	1870
Lawford,†‡ H. B. Esq., C. S.	1865
Leeds, Henry Esq., Conservator of Forests, Bengal, Calcutta	1868
Lees, Major, W. M., Under-Secretary, Government of India, Military Department	1871
Leibert, M. Esq., Tea Planter, Hazareebaugh ...	1868
Lethbridge, T. C., Esq., Moorlah Factory, Chumparun ...	1871
Levinge, H. Esq., C. E., Arrah	1863
Lewis, Hon'ble W. T. Resident Councillor, Penang ...	1840
Livesay, C. E. Esq., Tea Planter, Baroon via Dehree ...	1868
Llewhellin, W. Esq., Durbungah	1871
Lloyd, M. Esq., Indigo Planter, Shapore Oondee, Tirhoot	1863
Lloyd, W. Esq., Darjeeling	1869
Locke, H. H. Esq., Principal, Government School of Arts, Calcutta	1866

L.—(Continued.)

Admitted.

Lockhart, Capt., W. S. A., Dy. Assistant Quarter Master General, Morar 1871
Logan, J. O. Esq., Indigo Planter, Midnapore ... 1867
Lord, G. F. Esq., Manager, Bengal Coal Company, Raneegunge 1858
Lovell, Thos. Deputy Chief Engineer, Lucknow ... 1869
Lovell, Capt. H. P. Supdt., P. and O. Company, Calcutta 1870
Lowis,† E. E. Esq., Civil Service 1864
Lowis, J. M. Esq., Civil Service, Howrah ... 1865
Lowther,*† Robert, Esq., Civil Service 1836
Luchmeeput Sing, Roy Bahadoor, Banker, Calcutta ... 1864
Luchmessur Sing, Bahadoor, Zemindar, Mozufferpore, Tirhoot 1861
Lukin, Major F., 3rd Hussars, Ahmednuggur, Bombay ... 1860
Lushminarain, Lalla, Zemindar, Bareilly 1870
Lushington,† H. Esq., C. S. 1865
Lyall, R. D. Esq., Civil Service, Dacca 1869
Lynam, John Esq., Supdt., Reserve Police Force, Calcutta 1866

M.

MacDonald, C. Esq., Dowlutpore Factory, via Roosa, Tirhoot 1867
MacDonald, M. N. Esq., Portipore Factory, Sarun ... 1869
MacDonald, W. J. Esq., Tea Planter, Assam ... 1867
MacDougall, Major W. C. Deputy Inspector of Studs, Saharunpore 1867
Mackillican, J. Esq., Merchant, Calcutta 1865
Mackinnon, Capt. W. C., Dum-Dum 1870
Maclachlan, J. E. Esq., Calcutta 1861
Maclean, A. T. Esq., Civil Service, Baurisaul ... 1858
Macmillan, J. Esq., C. E., Cuttack 1865
Macnaghten, Chester Esq., Tutor, Rajkumar College, Rajkote, Kattywur 1869
Macneill, Lieut. Duncan, 41st M. N. I., Cuttack ... 1869
Macpherson, Hon'ble A. G. Judge of the High Court, Calcutta 1867
Macpherson, W. Esq., Civil Service, Cuttack ... 1861
Macpherson,*† George, G. Esq. 1836
Macdonald, Major John, Survey Department, Calcutta ... 1871
Macdonell, Brigadier Genl. A., C. B., Commanding Rohilkund District, Bareilly 1871
Mackenzie, Mr. S. C., Superintendent, Presidency Jail, Calcutta 1871

M.—(*Continued.*)

	Admitted.
Mackeson, Lieut.-Col. F. L., 2nd in Command, Meywar Bheel Corps, Kherwarrah, Rajpootana ...	1860
Madho Rao, Rajah, Bareilly	1871
Maharaj,* Dheraj Matabchunder Bahadoor, Rajah of Burdwan	1836
Maharajah* of Johore	1868
Maharajah of Betteah, Tirhoot	1870
Maharajah of Bhurtpore	1865
Maharajah of Cooch Behar	1864
Mahomed Alli Khan, Moonshee, Government Pleader, Dinagepore	1866
Mahony, H. C. Esq., Dhurrumkhole Factory, Silchar, Cachar	1869
Mainwaring, Col. R. R., 6th European Regt., Cawnpore	1861
Maitland, Capt. W. G., Asst. Commissioner, Seebsaugor, Assam	1871
Manager, Government Garden, Fyzabad, Oude	1871
Manager, Tarrapore Tea Garden, Cachar	1871
Manager, Chundypore Tea Company, Cachar	1862
Manager, Kanchunpore Tea Company, Cachar	1862
Manager, Victoria Tea Company, Cachar	1862
Manager, Bengal Tea Company, Cachar	1864
Manager, East India Tea Company, Assam	1865
Manager, Dahingeapore Factory, Assam	1865
Manager, Bowalea Factory, Cachar ...	1865
Manager, Koeyah Factory, Cachar ...	1865
Manager, Goomrah Factory, Tirhoot ...	1865
Manager, Narainpore Garden, Cachar	1865
Manager, Joypore Garden, Cachar ...	1865
Manager, Cutlee Cherra Garden, Cachar	1865
Manager of Raj Shewhur, Tirhoot ...	1870
Manager, Noakacharee Tea Company, Assam	1865
Manager, Public Garden, Bareilly ...	1868
Manager, East India Tea Company, Cachar	1866
Manager, Koomtar Tea Garden, Assam	1869
Manager, Chincooree Tea Estate, Cachar	1870
Mandelli, L. Esq., Tea Planter, Darjeeling ...	1868
Manikjee,* Rustomjee, Esq , Merchant, Calcutta	1837
Manook, Dr. S. J., Civil Surgeon, Chyebassa	1866
Marindin, Capt. P. S., R. E., Allahabad ...	1871
Marinden, H. C. Esq., Barrister-at-Law, Calcutta	1869
Markby,† Hon'ble W., Judge of High Court	1866
Marquard,† C. Esq., Merchant ...	1862
Marsden, F. J. Esq., Barrister, Calcutta ...	1870
Martin, W. B. Esq., Tea Planter, Punkabaree, Darjeeling	1868

M.—(Continued.)

Admitted.

Maseyk, J. W. Esq., Indigo Planter, Jungypore ... 1858
Master, C. G., Esq., M. C. S., Chatterpore via Gangam... 1871
Masters,*† J. W. Esq. 1835
Matthews, F. E. G., Esq., Kumaon Iron Works, Kaladoongee near Nynee Tal 1871
Maunsell, Lieut.-Col. F. R., Chukrata 1870
Maxwell, Col., H. H., R. A., Superintendent, Gun Foundry, Cossipore 1871
Mayne, F. O. Esq., C. B., Civil Service, Allahabad ... 1869
McAlpine, Robert Esq., Futtickcherry Estate, Chittagong 1865
McDonell,† W. F. Esq., Civil Service ... 1866
McFarlane, A. C. Esq., Merchant, Calcutta ... 1870
Melvill, Hon'ble Maxwell, Judge of the High Court, Bombay 1871
Mercer, Lieut.-Col. T. W. Dhurumsala ... 1866
Meres, W. F. Esq., Civil Service, Hooghly ... 1870
Mesurier, C. B. Le Esq., Allahabad 1861
Meugens, J. G. Esq., Merchant, Calcutta 1865
Millar, Major F. J., Deputy Commissioner, Mooltan ... 1869
Miller, Edward Esq., Merchant, Calcutta 1850
Millie, W. J. Esq., Tea Planter, Chittagong ... 1866
Mills,*† Andrew John Moffat, Esq. 1836
Mills, Lieut.-Col. H., Dy. Asst. Commissary General, Bareilly 1871
Minchin, F. J. V. Esq., Aska, Ganjam 1862
Minchin, Charles Esq., Merchant, Bimlipatam ... 1864
Minto, W. Esq., Debrooghur, Assam 1862
Mitchell, R. Esq., Merchant, Calcutta 1868
Mohes Chunder Banerjee, Baboo, Cuttack 1869
Mohima Rungun Roy Chowdry, Zemindar, Kakinia, Rungpore 1865
Mohendrolall Khan, Koomar, Narajole, Midnapore ... 1871
Molony, E, Esq., C. S., Commissioner, Rampore Beauleah 1866
Money,*† W. James Henry, Esq., Civil Service ... 1837
Money,† Major R. C., Deputy Commissioner ... 1860
Moody, John, Esq., Raneegunge 1870
Moore, C. W. Esq., C. S., Azimghur 1865
Moran, F. C. Esq., Manager, Rungorah Factory, Debroghur 1870
Morris,† J. H. Esq., Civil Service 1868
Mordan Alie Khan, Mahomed, Prime Minister, Marwar, Jodhpore 1870
Mosely, T. H. Esq., Merchant, Calcutta 1862
Mowbray, Arthur H. Esq., Merchant, Calcutta ... 1866
Muir, Hon'ble Sir W., K.C.S.I., Lieutenant-Governor of N. W. P., Allahabad 1869

M.—(*Continued.*)

Admitted.

Mullen, Dr. T. Ffrench, Residency Asst. Surgeon, Ulwar, Rajpootana 1871
Murdoch, A. W., Esq., C. E., Serajgunge 1870
Murdoch, James, Esq., Merchant, Calcutta ... 1871
Murray, Col. J. J. Commandant, 14th Bengal Cavalry, Deolee 1867
Murray, Capt. W. G., Revenue Survey, Calcutta ... 1870
Murray, Capt. J., Asst. Conservator of Forests, Mussoorie 1870
Muspratt,† J. R. Esq., Civil Service 1847

N.

Naesmyth† J. Esq., Civil Service 1852
Nawab, Nazeer Ally Khan Bahadoor, Calcutta ... 1862
Nembhard, Lieut.-Col. W., Commissioner, East Berar, Oomraotee 1861
Newton, Thos. Esq., Barrister-at-Law, Allahabad ... 1870
Nickels,‡ C. Esq., Indigo Planter 1866
Niladhur Singh Deo, Rajah Bahadoor, Sonepore, Sumbulpore 1870
Nobin Chunder Nag, Baboo, Zemindar, Midnapore ... 1866
Noble, Capt. C. S., Assistant Settlement Officer, Lucknow 1870
Noor Khan, Huzrut, Minister of Jowrah ... 1871
Nuthall, Major General W. F., Political Agent, Munnipore 1871

O.

Oboychurn Goho, Baboo, Merchant, Calcutta ... 1856
Odling, C. W. Esq., C. E., D. P. W., Bhuddruck ... 1871
Ogbourne, C. H. Esq., Calcutta 1867
Ogilvy, J. F. Esq., Merchant, Calcutta 1865
O'Keef, J. W., Esq., Merchant, Calcutta 1871
Oldham, Wilton Esq., LL.D., Civil Service, Ghazeepore ... 1867
Onraet, P. T. Esq., Bhaugulpore 1857
Onasch, Revd. H. Ranchee, Chota Nagpore 1869
Orchard, Major W. A. D., B. S. C., Barrack Master, Meerut 1871
Orr, J. Cave Esq., Solicitor, Calcutta 1868
Orr, Lieut.-Col. Alexander P., Roy Bareilly, Oude ... 1868
Osborne, Col. Willoughby, F.R.G.S., F.G.S., Political Agent, Bhopal, Sehore 1862
Osborne, Captain J. H. Willoughby, Revenue Survey, Debrooghur 1870
Owen,† Lieut.-Col. W. G., (12th Madras N. I., ... 1846
Owen,† Lieut.-Col. A. W., Executive Engineer ... 1865

P

Admitted.

PADDAY, Capt. A. C., Royal Engineers, Bareilly ... 1871
Palmer, Charles, Esq., Medical Service, Calcutta ... 1848
Palmer,* T. A. G., Esq., Cawnpore 1861
Park, Robert Esq., Indigo Planter, Colgong ... 1865
Parrott, Lieut.-Col. B., Stud Department, Kurruntadhee... 1867
Parker, W. H., Esq., Executive Engineer, Gwalior Division, Gwalior 1871
Patterson, A. B., Esq., Civil Service, Futtehpore ... 1871
Paske, Dr. C. T., Civil Surgeon, Mirzapore ... 1869
Payne, Dr. A. J., Medical Service, Calcutta ... 1860
Payne, H. F. E. B. Railway, Sealdah ... 1869
Peal, S. E. Esq., Tea Planter, Sapakattee, Seebsaugor, Assam 1867
Pearl, J. Esq., Tea Planter, Rajmore Tea Estate, Seebsaugor, Upper Assam 1870
Peary Mohun Banerjee, Baboo, Pleader, High Court, N. W. P., Allahabad 1868
Peddie, Graham, Esq., District Engineer, E. I. Railway, Allahabad 1865
Peel, Fredk., Esq., Merchant, Calcutta 1871
Pellew, F. H. Esq., Civil Service, Hooghly ... 1863
Peppè, T. F. Esq., Chota Nagpore 1868
Perkins, Dr. R. H., Benares 1859
Perrin, Monsieur J., Silk Filatures, Berhampore ... 1859
Pertap Narain Sing, Baboo, Deputy Magistrate, Bood-Bood 1863
Peterson,† A. T. T. Esq., Barrister, High Court ... 1849
Peterson, Frederick Esq., Secy., Simla Bank, Simla ... 1862
Phear, the Hon'ble J. B., Calcutta 1867
Phillippe, Clement Esq., Indigo Planter, Balacole, Pubna 1851
Phillips, James Esq., Indigo Planter, Shikarpore via Koosteah 1858
Phillips, A. Esq., Barrister-at-Law, Calcutta ... 1870
Pickance, Lieut. W. John, Madras Staff Corps, Chutterpore, Ganjam District 1867
Peachy, Dr., David, Purneah 1871
Pigott, William Esq., Broker, Calcutta 1864
Pinney, G. F., Esq., Jorehaut Tea Company, Assam ... 1871
Plowden, W. C. Esq., Civil Service, Meerut ... 1869
Pogose, J. G. N. Esq., Zemindar, Dacca 1856
Pollok, Major F. T., (Madras Army) Executive Engineer, Gowhatti 1860
Porter,† G. [illegible] Esq., Civil Service 1863
Pott, A. C. Esq., Merchant, Calcutta 1870

P.—(*Continued.*)

	Admitted.
Poorna Chunder Roy, Zemindar, Serapoolly ...	1870
Poulton, Major H. B. A., Bengal Staff Corps, Saugor ...	1865
Powell, Alfred, Esq., Saharunpore	1871
Power, Ambrose W. B. Esq., C. S., Hill Tipperah, Comillah	1869
Pratapa Chandra Ghosa, Baboo, Calcutta ...	1869
Prentis, C. Esq., Civil Surgeon, Gorruckpore ...	1866
Prestage, Franklin, Esq., C. E., Sealdah ...	1870
Price, Charles E. Esq., Calcutta	1870
Pringle, R. B. Esq., Badalipar Tea Garden, Assam ...	1870
Prinsep, H. T. Esq., Civil Service, Patna ...	1870
Prior, General Chas., Commanding at Dhurmsalla ...	1867
Proprietors, Jugdispore Estate, Beelrea, Shahabad ...	1869
Prothero, Lieut. Montague, Madras Staff Corps, Asst. Superintendent of Port Blair	1869
Prosono Coomar Banerjee, Calcutta	1871
President, Municipal Committee, Allyghur ...	1870
Punchanana Mitter Baboo, Calcutta	1870
Pyne, R. Esq., Nulgunge, Purneah	1867

Q.

QUINTON,† J. W. Esq., Civil Service	1865

R.

RABAN, Lieut.-Col. H., Shilling	1858
Radcliffe, John, Esq., Merchant, Calcutta ...	1871
Rajah of Bhadawar, Agra	1869
Rajah of Kuntil, Mirzapore	1871
Rajkissen Mookerjea,* Baboo, Landholder, Ooterparah ...	1836
Ramdass Sen, Baboo, Zemindar, Berhampore ...	1869
Ram Rungun Chuckerbutty, Zemindar of Heetapore, Beerbhoom	1869
Ramanauth Tagore, Baboo, Calcutta	1842
Ramanymohun Chowdry, Baboo, Zemindar, Rungpore ...	1861
Ramessur Roy Chowdry, Baboo, Zemindar, Allahabad ...	1868
Rattray, Haldane, Esq., Asst. Supdt. of Police, Pakour ...	1871
Ravenshaw, T. E. Esq., Civil Service, Cuttack ...	1865
Reay, Lieut.-Col. Chs., Benares	1871
Redpath, R. Esq., Assistant Superintendent of Police, Myanoung District, Henzadah, Burmah	1868
Reid, J. R. Esq., C. S., Azimgurh	1866
Reinhold,† H. Esq., Merchant ..	1862
Riach, F. S. M. Esq., Rosecandy, Cachar ..	1870
Richards,*† J. Esq., Merchant ..	

R.—(*Continued.*)

Admitted.

Richardson, R. J., Esq., Civil Service, Ghazeepore ... 1871
Ridge, W. Esq., Furreedpore, via Berhampore ... 1866
Ripley,† Lieut.-Col. F. W. ... 1849
Ritchie, D. W. Esq., Offg. District Supdt. of Police, Chyebassa 1871
Robarts, Lieut.-Col, Charles, Commandant, 17th Bengal Cavalry, Seetapore 1862
Robarts, H. Esq., Indigo Planter, Bellah, Allyghur ... 1870
Roberts, Robert Esq., Chief Auditor, E. I. R., Calcutta ... 1870
Robertson, J. C. Esq., Civil Service, Allahabad ... 1870
Robinson, S. H. Esq., Merchant, Calcutta ... 1854
Robinson,† J. Hamilton, Esq., Merchant ... 1863
Robinson,† W. Esq., District Engr., Delhi Railway ... 1667
Robinson, W. A., Esq., Umballa 1871
Robinson, Revd. Julian, Allahabad 1869
Rochfort, W. B. Esq., District Supdt. of Police, Howrah 1868
Rodrigues, F. Esq., Merchant, Calcutta ... 1871
Rogers, Arcbd. Esq., Solicitor, Calcutta 1858
Rogers, Lieut., G. W., 4th Goorkas, Bukloh, Punjab ... 1871
Roodurpurshaud Chowdry,* Nanpore, Tirhoot ... 1867
Roordur Purtab Sing,* Rajah Bahadoor, Dewan of Punna 1868
Roquet, V. Esq., Indigo Planter, Moharagunge Factory, Azimghur 1860
Ross,† Mars Esq., Merchant 1865
Row, Col. W. S., (33rd N. I,) Lucknow 1854
Row, G. L. Narsing, Esq., Admiralty, Madras ... 1871
Rowett, J. T., Esq., Merchant, Rangoon 1871
Ruddock, E. Esq., B. C. S., Bankipore, Patna ... 1868
Russeed Khan Chowdry, Moulvee, Mahomed, Zemindar, Nattore 1871
Russell, T. M. Esq., Calcutta 1868
Ruxton,† G. Esq., Merchant 1861
Ryder, Lieut.-Col., S. C. D., Jubbulpore ... 1858

S.

Sagore Dutt, Baboo, Merchant, Calcutta ... 1850
Samachurn Law, Baboo, Merchant, Calcutta ... 1855
Samuells, Captain W. L., Assistant Commissioner, Purulia 1870
Sandys, Mrs. Annie, Bhaugulpore 1870
Saunders, F. W. Esq., Lullutpore 1871
Savi, J. R. Esq., Indigo Planter, Nohatta Jessore ... 1862
Savi, Thomas, Esq., Indigo Planter, Kishnaghur ... 1851
Sceales, Jamy, O'Brien, Esq., Choadangah ... 1869
Schiller,† F. Esq., Merchant ... ... [illegible]

S.—(*Continued.*)

Admitted.

Scott, Capt. G. J., Superintendent I. G. S. N. Company,
Calcutta 1870
Scott, P. G. Esq., Assistant Superintendent of Police
Durbhangah, Tirhoot 1869
Secretary, Agricultural Society, Satkhira 1871
Secretary, Public Garden, Azimghur 1871
Secretary, Local Fund Committee, Umritsur ... 1859
Secretary, Local Fund Committee, Ferozepore ... 1861
Secretary, Public Garden, Banda 1855
Secretary, Public Garden, Monghyr 1853
Secretary, Public Garden, Cawnpore 1860
Secretary, Cantonment Public Garden, Agra ... 1865
Secretary, Assam Company, Calcutta 1865
Secretary, Public Garden, Jaloun, Oorai 1866
Secretary, Govt. Garden, Muttra 1866
Secretary, Local Committee, Chindwarrah 1867
Secretary, Local Committee, Jahnsie 1867
Secretary, Local Fund Committee, Baitool 1869
Secretary, Local Fund Committee, Mozufferguth ... 1869
Secretary, Local Fund Committee, Raepore 1865
Secretary, Municipal Committee, Mirzapore... ... 1869
Secretary, Road Fund Committee, Jaunpore ... 1867
Secretary, Local Committee, Chanda 1870
Secretary, Municipal Committee, Jhung 1870
Secretary, Local Fund Committee, Belaspore ... 1871
Shahamut Allee Khan, Meer Bahadoor, Superintendent of
Rutteeana, Indore... 1870
Shamloll Dutt, Baboo, Calcutta 1871
Shaw, J. Esq., Sub-Deputy Opium Agent, Burhurwah,
Chumparun 1871
Shaw, D. T. Esq., Merchant, Calcutta 1865
Shearin, E. Esq., Merchant, Calcutta 1856
Shelley, Major T. M., late 11th Regiment, Morar ... 1871
Sheodial Sing,* H. H. Mohakhan, Rajah of Alwar ... 1863
Sherer, J. W. Esq., Civil Service, Allahabad... ... 1869
Sherriff, W. Esq., Jorrada, Jessore 1859
Shillingford, G. W. Esq., Kolasay Factory, Purneah ... 1867
Shortt,† T. H. H. Esq., Civil Service 1866
Skoulding, J. W. B. Esq., R. A., Veterinary Surgeon,
Saharunpore 1871
Sibley, George Esq., Civil Engineer, E. I. Railway, Cal-
cutta 1869
Simons, C. J. Esq., Tea Planter, Borsella Factory, Morar
Bazaar Post Office, Upper Assam 1863
n, James, Esq., Civil Service, Azimgurh ... 1856

S.—(*Continued.*)

	Admitted.
Skinner, A. Esq., The Abbey, Mussoorie	1854
Slater, E. M. Esq., Bank of Bengal, Calcutta ...	1870
Smalley, R. B. Esq., Ramporehaut	1867
Smith, G. M. Esq., Jeyhinga Tea Estate, Lukimpore Assam	1871
Smith, W. Esq., Calcutta	1871
Smith, R. H. Esq., Principal Sudder Ameen, Meerut ...	1860
Smith, James Esq., Shahpore, Tirhoot	1863
Smith, Thomas T. Esq., Rampoorah Factory, via Jeagunge	1864
Smith, C. M. Esq., Merchant, Calcutta	1865
Smith, W. H. Esq., Civil Service, Allyghur ...	[illegible]
Smith, Maxwell Esq., Hursingpore, Tirhoot	1869
Spankie, Hon'ble R., Civil Service, N. W. P., Allahabad	1865
Spencer, C. J. Esq., C. E., E. I. Railway, Ucharah ...	1863
Spicer, A., Esq., Tea Planter, Cachar	1869
Stalkartt, William Esq., Merchant, Cal., *(Vice-President)*	18[illegible]
Stalkartt, J. Esq., Merchant, Calcutta	1863
Steel, Donald, Esq., Eastern Cachar Tea Company, Cachar	1861
Steel, Lieut-Col. J. A., Bengal Staff Corps, Roy Bareilly, Oude	1868
Steel, Lieut. E. H., R. A., Revenue Survey, Derah Ghazee Khan	1870
Stephen, J. Esq., Dacca	1855
Stephenson,† Cecil Esq., Agent, E. I. Railway ...	1866
Sterndale, H. B. Esq., Bank of Bengal, Delhie ...	1870
Sterndale, R. A. Esq., Civil Service, Calcutta ...	1871
Stevens, H. W. Esq., Executive Engr., Durbangah ...	1867
Stevenson,*† William Esq., Junior, M. D.	1834
Stewart, A. N. Esq., Collector of Tolls, Jungypoor ...	1862
Stewart,† Dr. J. L.	1864
Stewart, A. Esq., Manager, Oornabund Garden, Cachar...	1870
Stewart, R. D. Esq., Raneegunge	1870
Stocks,‡ J. W. Esq., Gonatea, Synthia	1866
Stokes, Allen Esq., E. I. Railway, Howrah	1867
Stoney, R. V. Esq., Civil Engineer, Ungool via Cuttack	1866
Stoney, T. Butler, Esq., C. E., Dehree, Shahabad ...	1869
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Strand, A. Esq., Stock Broker, Calcutta	1870
Stuart, Alex. Esq., Raneegunge	1863
Stubbs, Lieut.-Col. W. H., 4th Regt. N. I., Allahabad ...	1868
Sturmer, Edwin Esq., Assistant Engineer, Canning Town, Mutlah	1863
Sturmer, John, Esq., Civil Engineer, Calcutta ...	1864
Sturmer, A. J. Esq., Talooka Kojha, via Gazeepore ...	1866
Weston, John [illegible] of the Patna Lunatic Asylum, Patna ...	1871
White, Robert [illegible] Tea Company, Assam ... Cachar	[illegible]

Admitted.

Supdt., Serajgunge Jute Company, Serajgunge ... 1868
Sutcliffe, James Esq., Principal of the Presidency College, Calcutta 1871
Sutherland, Charles J. Esq., Merchant, Calcutta ... 1858
Sutherland, H. C. Esq., Civil Service, Sylhet ... 1860
Sutherland, H. K. Esq., Merchant, Calcutta ... 1870
Sutherland, A. B. Esq., Merchant, Calcutta 1870
Suttyanund Ghosal, Rajah,* Bhookoylas 1869
Swinden, T. G. Esq , Calcutta 1855
Swinhoe, William Esq., Attorney, Calcutta 1859
Syed Wellayut Ali Khan, Patna 1871
Sykes, Arthur L. Esq., Merchant, Calcutta... ... 1869

T.

TARRUCK Nauth Dutt, Baboo, Calcutta 1866
Taylor, V. T. Esq., Civil Service, Bhaugulpore ... 1860
Taylor, W. C. Esq., Cuttack 1858
Taylor, Frank, Esq., Executive Engineer, E. I. Irrigation and Canal Company, Hidgelee 1868
Temple, the Hon'ble Sir R., K.C.S.I., Calcutta ... 1869
Templer, Lieut.-Col. H. J., Staff Corps, Bareilly ... 1871
Tennant, Major T. E., Calcutta 1868
Thelwall, Col. J. B., C. B., Meean Meer 1851
Thomas, J. Esq., Merchant, Calcutta 1867
Thomas, J. P. Esq., Merchant, Calcutta ... ... 186[illegible]
Thompson,† Lieut.-Col. E., Political Agent of ... 18[illegible]
Thompson, Rivers Esq., Civil Service, Calcutta ... 1864
Thompson,* Dr. R. F., Hooghly... 1865
Thompson, A. B. F. Esq., Calcutta 1869
Thompson, J. A. Esq., Chandeeghat Tea Garden, Cachar 1871
Thompson, Henry, Esq., Manager, Moran Tea Company, Seebsaugor, Assam 1870
Thompson, Ninian, Esq., Judge, S. C. Court, Calcutta ... 1862
Thorpe, J. Esq., Lucknow 1867
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Tonnerre, Dr. C. Fabre, Health Officer, Calcutta, (*Vice-President*) 1862
Toomly, Geo. Esq., Indigo Planter, Conti, Tirhoot ... 1870
Toynbee, G. Esq., Cuttack 1871
Trafford, Revd. John, Serampore 1863
Travers, Major-General James, V. C., Meerut ... 1869
Tregear, Richd., Esq., Kolinjura, Jaunpore ... 18[illegible]6
Tucker, W. T. Esq., Civil Service, Bancoorah ... 185[illegible]
Tucker, Robert Esq., Tea Planter, Seebsaugor ... 1856

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Turnbull, C. S. Esq., Silk Manufacturer, Ghuttal ... 1853
Turnbull, the Hon'ble G. D., Civil Service, Meerut ... 1865
Turnbull,† Robert Esq., Merchant ... 1865
Turner,† H. B. H. Esq., Merchant ...
Turner, Hon'ble C. A., Allahabad ...
Turner, H. G. Esq., Madras Civil Service, Vizagapatam 1869
Twynam, Capt. E. J. L., Executive Officer, Prome ... 1856
Tytler, A. G., Esq., Sub-Deputy Opium Agent of Allyganjee, Sewan ... 1871

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Unwin, Howard, Esq., C. E., Irrigation Dept., Burdwan... 1869

V.

Vancutsem, E. C. Esq., Merchant, Calcutta 1868
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Vernon, John Esq., Executive Engineer, Debrooghur ... 1871
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W.

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